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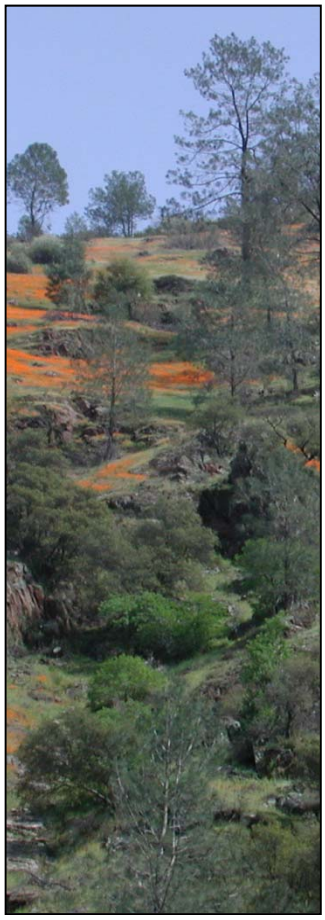
# Yosemite National Park Vegetation Classification and Mapping Project Report

Natural Resource Technical Report NPS/YOSE/NRTR—2012/598



**ON THE COVER**
Gray pine woodland alliance, Merced River canyon, Mariposa County, California
Ponderosa pine-incense-cedar forest alliance, Near Cascade Creek, Yosemite National Park, California
Meadow, subalpine forest, and alpine habitats, Virginia Canyon and Shepherd Crest, Yosemite National Park, California
Willow spp./meadow shrubland mapping unit, above Barney Lake, Hoover Wilderness, Humboldt-Toiyabe National Forest
Photographs by: USGS / Peggy E. Moore

# Yosemite National Park Vegetation Classification and Mapping Project Report

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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# Summary

The area mapped for this project encompasses Yosemite National Park and a surrounding buffer area for a total of approximately 561,731 ha (nearly 1.4 million acres). This area includes an extremely diverse array of habitats including grasslands, chaparral, broad-leaved evergreen and deciduous oak woodlands, coniferous forests and woodlands, montane wetland scrubs and meadows, extensive alpine areas, and Great Basin woodlands and sagebrush–bitterbrush scrubs. We mapped the vegetation of Devils Postpile National Monument, within the coniferous forest zone at the headwaters of the San Joaquin, as part of this project.

The Yosemite mapping project was initiated in 1996 as a cooperative endeavor between NatureServe, Environmental Systems Research Institute (ESRI), Aerial Information Systems, Inc. (AIS), the National Park Service (NPS), and the U.S. Geological Survey (USGS). Aerial photography was acquired in 1997, and field sampling occurred in 1998 and 1999 to support development of a vegetation classification for the park and vicinity. The photointerpretation phase for the Yosemite project was completed between 2000 and 2002, and the accuracy assessment (AA) data collection phase took place from 2002 to 2003. Accuracy assessment data were analyzed and the map finalized in 2006 with reporting completed in 2007.

The mapping standards conformed to those set by the Federal Geographic Data Committee and the USGS-NPS Vegetation Mapping Program. These include the federal standard for vegetation classification, standard data definitions (metadata), positional accuracy of 12.2 m, a minimum mapping unit of 0.5 hectare, and plant taxonomy that follows the Integrated Taxonomic Information System.

A primary product of this work is a vegetation classification following the United States National Vegetation Classification system (USNVC). New and existing data contributed approximately 1,900 samples to development of the classification for the mapping area.

The final classification consists of a classification in the USNVC hierarchy, a semi-dichotomous key, and type descriptions consisting of scientific name, common name, range, environmental description, most abundant species, characteristic species, vegetation description, conservation rank, and the field plots used to describe each association. The vegetation classification for Yosemite was completed in 2003, and we have made no attempt to update it based on more recently published ecological studies or refinement of the USNVC at a national or state level since that time.

The final vegetation classification for Yosemite National Park and vicinity consists of 114 alliances and 209 associations. At the association level, there are 106 forests and woodlands, 43 shrublands, seven dwarf-shrublands, and 53 herbaceous vegetation types. We defined 105 new associations using data collected and analyzed during the course of this project. There were approximately 87 associations previously defined by other authors that occur in Yosemite or the environs according to field plot data.

Concurrently, the photointerpreters worked with project ecologists to develop a mapping classification aligned with the vegetation classification but interpretable in 1:15,860 color infra-red aerial photography. The photointerpretation process involved preliminary delineation of

aerial photos, reconnaissance with ecologists (to label line work and associate photo signatures with vegetation types), full delineation of photography by ecological zones, and field verification.

Within the park, the photointerpreters mapped 56% as forest, 18% as woodland, 7% as shrubland, and 3% as herbaceous. Evergreen forests, including both needle-leaved and broad-leaved evergreen forests, dominate at nearly 55% of the park. Within mapped evergreen forest, 94% is needle-leaved evergreen forest and only 6% is broad-leaved evergreen forest. Evergreen and deciduous shrublands occur in nearly equivalent proportions, with deciduous shrublands consisting largely of shrub willow types. Of the 9,903 ha of herbaceous vegetation, 63% is mapped as wetland and 37% is mapped as upland based on photo signatures.

The final map has 107 different mapping classes at various levels in the classification hierarchy, within Yosemite National Park (Appendix H). These classes, including alliances, associations, and other mapping units, are mapped among 45,540 different stands (polygons), including sparsely vegetated types. There are 12 sparsely vegetated types, including alpine talus slope, alpine scree slope, boulder field, and dome. There are 45 forest classes, 22 woodland classes, 16 shrubland classes, 1 dwarf-shrubland class, and 8 herbaceous classes mapped within the park. There are 3 unvegetated types: water, permanent snowfield/glacier, and urban/developed.

Sierra lodgepole pine forest alliance occupies the greatest area of any mapped alliance (10% of the park) followed by Jeffrey pine woodland alliance, California red fir forest alliance, and western white pine-(California red fir-Sierra lodgepole pine) forest superassociation. The latter three occupy nearly equal area between 24,000 and 25,000 ha each (7.7 to 7.9% of the park). Montane white fir-sugar pine forest alliance and subalpine whitebark pine woodland alliance occupy nearly equal area between 18,000 and 19,000 ha each (6.0 and 5.7% of the park, respectively). Among the alliances occupying the least area in the park are chamise shrubland alliance, a very common low elevation chaparral in California, and black cottonwood temporarily flooded forest alliance, a species largely limited to narrow riparian and meadow-edge areas at low elevations within the mapping area.

There are an additional 23 classes mapped within the environs that do not occur within Yosemite National Park, bringing the total number of types mapped within the environs, the park, and the monument, together, to 130. These are mapped among 84,955 polygons, including sparsely vegetated types.

Photointerpreters mapped 21 different types within Devils Postpile National Monument (DEPO) in 84 different stands (polygons), not counting exposed rock and water. Approximately 2% of the monument was mapped as broad-leaved deciduous forest, 69% as needle-leaved evergreen forest, 18% as deciduous shrubland, 1.6% as evergreen shrubland, and 2% as herbaceous. Nearly 5% was mapped as exposed rock and 2.7% as water.

California red fir-white fir forest alliance was the most commonly mapped type within DEPO at 44% followed by mesic montane shrubland mapping unit at 16%. California red fir forest alliance and Sierra lodgepole pine woodland alliance were the next most common at 11% and 9%, respectively. All other types mapped each comprised less than 5% of DEPO.

Assessing photointerpretive map accuracy involved field observations at nearly 2,200 sites across the mapping area. Following analysis of accuracy assessment data, we aggregated some types to achieve target accuracy levels. Results following aggregations are reflected above. Of the 91 final mapping classes for which accuracy was assessed, 62 (68%) have an estimated accuracy of 80% or greater. Among the highest accuracy estimates for those types with more than 10 AA points, were for curl-leaf mountain mahogany woodland alliance (94%), Sierra juniper/curl-leaf mountain mahogany/big sagebrush woodland association (93%), and Sierra lodgepole pine forest alliance (93%). The lowest accuracy levels were for canyon live oak/whiteleaf manzanita (68%) and California red fir-white fir forest alliance (69%). Twenty-nine classes at the association level did not reach 80% accuracy. Global accuracy at the association or equivalent mapping unit level is 81%. Global accuracy at the alliance level is 84%.

The final products include:

- Vegetation map of Yosemite National Park, Devils Postpile National Monument, and environs in digital format
- Descriptions of each vegetation type
- Key to vegetation types
- Source data (e.g. imagery)
- Ecological field plot data
- Photographs from ecological field plots and accuracy assessment points
- Related data and metadata files.
- Descriptions of types mapped from aerial photography
- Table relating mapped types to the vegetation classification
- Summary of mapping accuracy by type

Final products are available at the NPS Vegetation Inventory Program web page (http://science.nature.nps.gov/im/inventory/veg/index.cfm).

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# Introduction

## The USGS-NPS Vegetation Mapping Program

The U.S. Geological Survey (USGS) and National Park Service (NPS) formed a partnership in 1994 to map the vegetation of United States national park system units using the U.S. National Vegetation Classification (USNVC) (Grossman et al., 1998). Adoption by the Federal Geographic Data Committee made this system part of the standard for reporting vegetation information among federal agencies (FGDC 2008). Goals of the NPS mapping projects include providing baseline ecological information to resource managers in the parks; putting these data into regional and national contexts; and providing opportunities for future inventory, monitoring, and research activities. Each park developing a vegetation map follows a standardized field sampling and vegetation classification protocol to document the various vegetation types found in a given park. The final products include a vegetation map in digital format, descriptions of each vegetation type, a key to the types, source data (e.g. imagery), ecological field data, and all related data and metadata files (e.g., original field forms, plot database, accuracy assessment data, etc.).

Several parks, representing different regions, environmental conditions, and vegetation types, were chosen by USGS to be part of the prototype phase of the program. The initial goal of the prototype phase was to "develop, test, refine, and finalize the standards and protocols" to be used during the production phase of the project. This included the development of a standardized vegetation classification system for each park and the establishment of photointerpretation (PI), field data collection, and accuracy assessment (AA) procedures.

Yosemite National Park (YOSE, park) was selected as a prototype Inventory and Monitoring Program mapping project. The park was established in 1890 and is located on the western slope of the central Sierra Nevada range of California. In addition to the park, an area of over 2,525 square kilometers of land adjoining the park and representing environments on the west and east slopes of the range was mapped. Devils Postpile National Monument (DEPO), a unit of the National Park Service situated within the mapping area, was also mapped as part of this project.

## Vegetation Mapping Program Standards

For its Vegetation Inventory program, the NPS Inventory and Monitoring program, in close cooperation with the USGS, adopted standards established by the Federal Geographic Data Committee (FGDC 2008) for vegetation mapping on federal lands. The FGDC web site, www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation, explains the development of the classification standards now used for mapping and classifying vegetation in national parks. The NPS Vegetation Inventory Program web site, http://science.nature.nps.gov/im/inventory/veg/index.cfm, has additional information on vegetation mapping in national parks. The basic program standards dictate the scale (1:24,000), minimum mapping unit (0.5 ha), target positional accuracy (within 12.2 meters [40 feet] of actual location), and thematic accuracy (overall map as well as individual map classes attain 80% accuracy) (USGS, 2007).

The vegetation classification applied in this report when referring to vegetation communities (versus mapping units) is the U.S. National Vegetation Classification (USNVC). It was developed by NatureServe (formerly part of The Nature Conservancy) in partnership with the

network of State Natural Heritage Programs. Additional support was provided by federal agencies and the Ecological Society of America. This project used the 1997 version of the classification and hierarchy (Grossman et al., 1998). The vegetation classification presented here was completed in 2003 (Keeler-Wolf et al., 2003), and we have not updated the classification based on more recently published ecological studies or refinement of the USNVC at a national or state level since that time.

The 1997 USNVC hierarchy incorporated seven physiognomic-floristic levels for terrestrial vegetation (Table 1), and the YOSE classification is organized within this hierarchy. Upper levels reflected growth form (e.g., woodland vs. shrubland), structure, leaf phenology, and leaf types. Lower levels used floristics as the primary basis for classification. An alliance is a lower level unit in the classification hierarchy and is defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species typically at least one of which is found in the uppermost or dominant stratum of vegetation. Examples include California red fir (*Abies magnifica*) forest alliance, huckleberry oak (*Quercus vacciniifolia*) shrubland alliance, and shorthair reed grass (*Calamagrostis breweri*) herbaceous alliance. Associations are the lowest level within the USNVC hierarchy. They have a characteristic range of species composition, diagnostic species occurrence, habitat conditions, and physiognomy, and they reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes. Examples include California red fir-western white pine/pinemat manzanita forest and huckleberry oak-bush chinquapin shrubland.

Table 1. The U.S. National Vegetation Classification physiognomic-floristic hierarchy for terrestrial vegetation (Grossman et al., 1998) with examples from Yosemite National Park.

| Level | Primary Basis for Classification | Example (Colloquial Name) |
|---|---|---|
| Class | Growth form and structure of vegetation | Forest |
| Subclass | Growth form characteristics, eg.g., leaf phenology | Deciduous Forest |
| Group | Leaf types, corresponding to climate | Cold-deciduous Forest |
| Subgroup | Relative human impact (natural/semi-natural, or cultural) | Natural/Semi-natural |
| Formation | Additional physiognomic and environmental factors, including hydrology | Temporarily Flooded Cold-deciduous Forest |
| Alliance | Dominant/diagnostic species of uppermost or dominant stratum | Black Cottonwood Temporarily Flooded Forest Alliance |
| Association | Additional dominant/diagnostic species from any strata | Black Cottonwood-Jeffrey Pine Forest |

For the Yosemite project, image interpretation and vegetation classification were done in concert so that vegetation pattern and classification could inform each other to produce the highest quality map. Canopy density was assigned to each polygon along with vegetation class, land use, and fire severity where applicable. In some instances, aggregated mapping units are used to address vegetation where an alliance or association is not discernable on the aerial photography. Thus, not all vegetation communities (i.e., alliances and associations) described in this report are necessarily mapped directly.

## Vegetation Classification vs Mapping Classification

The mapping criteria at YOSE conform to the standards set for parks greater than 60,700 ha (150,000 acres). Photointerpreters delineated vegetation units and assigned attributes to the finest

level possible within the USNVC. Most mapping units tended to fall into similar ecological groups which nest generally between the association and alliance level in the USNVC hierarchy. At times, photointerpreters were able to map to described associations that corresponded to image signatures or well defined biogeographical characteristics while in other situations mapping was completed at more generalized levels in the hierarchy.

## Project Area Information

### *Yosemite National Park*

Yosemite National Park was one of the first national parks to be established, with Yosemite Valley and the Mariposa Grove of giant sequoias set aside by Congress in 1864 and the remainder of the park established in 1890. The current park boundary encompasses approximately 302,692 ha (1,169 square miles; 747,958 acres) in east central California (Figure 1). However, the vegetation mapping project encompasses a larger area totaling about 561,731 ha (nearly 1.4 million acres) and referred to in this report as "environs." This area includes an extremely diverse array of habitats including grasslands, chaparral, broad-leaved evergreen and deciduous oak woodlands, coniferous forests and woodlands, montane wetland scrubs and meadows, extensive alpine areas, and Great Basin woodlands and sagebrush–bitterbrush scrubs. It provides a vegetation transect across a representative portion of the Sierra Nevada from 425 m (1,400 feet) on the western slope to 4,000 m (13,114 feet) at the crest of the range and down to approximately 1,980 m (6,500 feet) in the Mono Lake basin at the western edge of the Great Basin. Including the buffer area outside the park, the project covers not only lands administered by the National Park Service, but extensive lands administered by the Forest Service (USFS) in four national forests (Stanislaus, Sierra, Humboldt-Toiyabe, and Inyo) as well as lands administered by the Bureau of Land Management east of the Sierra Nevada crest. There are small pockets of private land scattered throughout the

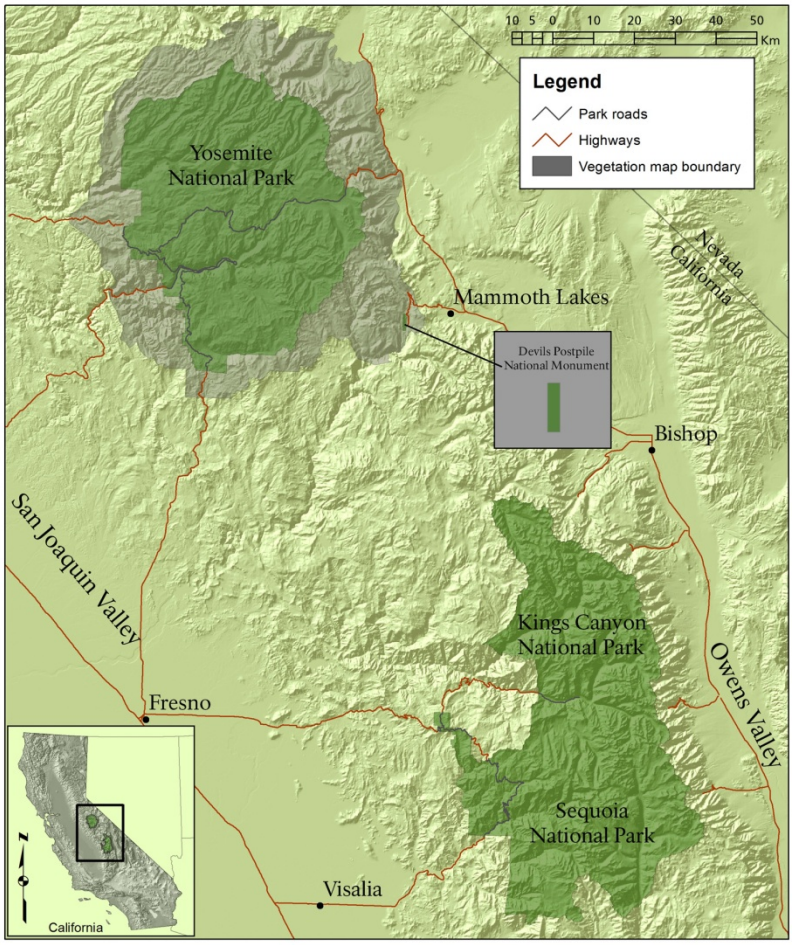


Figure 1. Yosemite National Park is located on the western slope of the Sierra Nevada in eastern-central California. Southeast of Yosemite, Devils Postpile National Monument is situated along the Middle Fork of the San Joaquin River. The mapping area encompasses both of these NPS units.

environs.

The park lies entirely on the gentle western slope of the Sierra Nevada, the crest of the range defining the eastern park boundary and the beginning of the steep eastern escarpment. Yosemite is famous for massive granite walls and domes, and granitic rock dominates park geology. Metamorphic rock occurs along the western boundary in the foothills and along the southeastern and eastern boundaries (it dominates much of the environs east of the park). Erosional processes that formed the deeply incised landscape also removed 95% of metamorphics that once overlaid the intruding plutonic rock (Huber 1987). Volcanic rock is even less common within the park with Rancheria Mountain and Little Devils Postpile being notable features. Soils tend to be shallow and more poorly developed with increasing elevation.

The park comprises two major watersheds, the Tuolumne River in the north and the Merced River in the south, and completely encompasses the headwaters of each. The environs adds portions of the Walker River in the northeast and the San Joaquin River in the southeast. During late Cenozoic uplift of the range, river gradients steepened creating deeply incised river canyons on both the western and eastern slopes. Subsequent glaciers during the Pleistocene broadened some valleys and further shaped the landscape seen today.

Yosemite has a Mediterranean climate at its lowest elevations with warm, dry summers and cool, moist winters. The highest elevations have a boreal to alpine climate defined by an average temperature for the coldest month of less than -3°C (27°F). Mean maximum temperature is 20°C (68°F) at 1,220 m (4,000 ft) elevation; mean minimum temperature is 3° C (37°F) (Western Regional Climate Center 2008). Total annual precipitation averages 965 mm (38 in) at 1,220 m but can vary from 381 mm (15 in) to 1,753 mm (69 in). Cyclonic storms off the Pacific Ocean strongly concentrate precipitation in the winter months (December to March). Locally, an orographic effect causes precipitation levels to increase with elevation (Dettinger et al. 2004). The result is a system characterized by strongly seasonal precipitation followed by severe summer drought at the lower elevations and protracted seasonal plant growth across the higher elevations with the advance of snowmelt.

Two-thirds of Yosemite lies between 2,100 m and 3,050 m (6,890 and 10,000 ft) elevation where the vegetation is predominantly mixed coniferous montane and subalpine forests. These forests, as well as lower-elevation pine and oak woodlands, are interrupted by sparsely vegetated bedrock slopes and domes, reflecting widespread glacial influence on the landscape. Vegetation structure and composition vary according to aspect; elevation; topographic steepness, shape, and position (all determinants of moisture availability); and fire history. Fire, in concert with topography, affects vegetation pattern at the landscape scale according to spatial variability in fire severity and return interval (Taylor and Skinner 2003). Twentieth century fire suppression has also affected vegetation pattern with longer fire return intervals, increases in forest stem density, and shifts to more shade-tolerant species (Swetnam 1993, Parsons and DeBenedetti 1979, Agee et al. 1978).

### *Devils Postpile National Monument*

Devils Postpile National Monument is situated within the environs and southeast of Yosemite National Park along the Middle Fork of the San Joaquin River. It was established in 1911 by presidential proclamation and protects and preserves the Devils Postpile formation (one of the

world's finest examples of columnar basalt), the 101-foot high Rainbow Falls, and pristine mountain scenery. The trapezoid-shaped monument encompasses approximately 323 ha (1.25 square mile, 798 acres) between 2,200 and 2,500 m (7,200 and 8,200 ft) elevation. Its position on the western slope of the range and proximity to the eastern slope results in high species diversity with representatives from both ecosystems. Habitats include broad-leaved deciduous riparian woodlands, coniferous forests and woodlands, montane wetland scrubs, and a wet meadow.

## Ecological Zones

Because the environs is such a large area, it was necessary to identify ecological zones to aid in project planning and implementation. Delineation of ecological zones was largely based on elevation zones, with each elevational break corresponding to a major vegetation transition (e.g., mixed conifer to fir belt, fir belt to subalpine, subalpine to alpine). The zones, numbered one through eight, serve as a geographical orientation to the study area and are briefly discussed below.

### *Zone 1: West Slope Oak–Chaparral*

This west slope zone ranges from 425 to 900 m (1,400 to 3,000 ft) in elevation and contains primarily foothill chaparral and oak woodlands. The majority of this zone is outside the park. It ranges from the confluence of the South Fork Merced River with the Merced River to Yosemite Valley in the Merced drainage and from the confluence of the Middle Tuolumne River with the Tuolumne River to Hetch Hetchy in the Tuolumne drainage. At the upper elevations of Zone I, the transition to mixed conifer occurs, characterized by ponderosa pine (*Pinus ponderosa*) and incense-cedar (*Calocedrus decurrens*). The geologic substrate is largely metamorphic outside of the park and largely granitic inside the park. Slopes are steep and rugged, and vegetation is strongly influenced by aspect. Vegetation is also strongly influenced by the relatively hot and dry summers and the relatively warm winters. Snowfall is intermittent and most precipitation falls as rain. The predominant species in this zone are chamise (*Adenostoma fasciculatum*), whiteleaf manzanita (*Arctostaphylos viscida*), blue oak (*Quercus douglasii*), interior live oak (*Quercus wislizeni* var. *wislizeni*), gray pine (*Pinus sabiniana*), annual grasslands, and low elevation riparian stands.

### *Zone 2: West Slope Lower Mixed Conifer*

This west slope zone ranges from approximately 900 to 1525 m (3,000 to 5,000 ft) in elevation and contains primarily mixed coniferous forests. The majority of this zone is inside the park. It represents most of the lowest elevation areas in the western portion of the park and includes such areas as Yosemite Valley, Wawona, and Hodgdon near the Big Oak Flat Entrance Station.. The geology is almost entirely granitic. Precipitation falls as both rain and snow, and the snow level for winter storms is often in this elevation range. The predominant species in this zone are canyon live oak (*Quercus chrysolepis*), ponderosa pine, California black oak (*Quercus kelloggii*), Douglas-fir (*Pseudotsuga menziesii*), and incense-cedar.

### *Zone 3: West Slope California Red Fir Belt*

This west slope zone ranges from 1525 to 2130 m (5,000 to 7,000 ft) in elevation. The majority of this zone is inside the park, and DEPO falls entirely within this zone. It ranges from Crane Flat to Tenaya Lake and from Chinquapin to Glacier Point. The geologic substrate is almost entirely granitic, except for some volcanic mudflows in the northwest part of the environs. Precipitation falls largely as snow, and this zone has the highest precipitation of the environs.

The terrain is gentle compared to other parts of the environs, with broad slopes instead of steep canyons and jagged peaks. Dense forests on alluvium and glacial deposits are composed of white fir (*Abies concolor*), California red fir (*Abies magnifica*), and sugar pine (*Pinus lambertiana*) plus western white pine (*Pinus monticola*) at the upper elevations. The three giant sequoia (*Sequoiadendron giganteum*) groves found within Yosemite occur in this zone. Jeffrey pine (*Pinus jeffreyi*) woodlands and montane chaparral occur on shallow soils and granitic knobs. Meadows and riparian thickets are predominant along the many creeks, streams, and saturated flats.

### *Zone 4: West Slope Subalpine Conifer*

This west slope zone ranges from 2130 to 2740 m (7,000 to 9,000 ft) in elevation. The majority of this zone is inside the park. It ranges from Tenaya Lake to Tioga Pass and Mono Pass. The geologic substrate is largely granitic with much of the area covered with a thin veil of soil over glacially scoured slopes and valleys. Extensive meadow complexes such as the Tuolumne Meadows are found in this zone, containing a complex matrix of hydric and mesic herbaceous and scrub vegetation. Predominant tree species include mountain hemlock (*Tsuga mertensiana*), Sierra lodgepole pine (*Pinus contorta* var. *murrayana*), and whitebark pine (*P. albicaulis*).

### *Zones 5 and 6: Alpine*

These zones straddle the crest of the Sierra Nevada, above 2740 m (9,000 ft). The alpine zone west of the crest (Zone V) is largely inside the park (except for the upper San Joaquin watershed and areas north of the park); the alpine zone east of the crest (Zone VI) is entirely outside the park. The geologic substrate is largely granitic and metamorphic with some volcanic. The slopes can be extremely steep, but there are also plateaus and benches with gentle slopes. Vegetation occurs in two settings: sparse low productivity upland sites and low-lying moist to hydric sites. Uplands may have low vegetative cover and be dominated by exposed outcrops, boulders, talus, and scree. Low-lying areas may have high vegetative cover in willow thickets and alpine meadows surrounding streams, tarns, and lakes. Variation in alpine vegetation appears to be driven more by differences in substrate than by position east or west of the Sierra Nevada crest.

### *Zone 7: East Slope Conifers*

This east slope zone ranges from 2130 to 2740 m (7,000 to 9,000 ft) elevation. It is entirely outside the park. The geologic substrate is granitic and metasedimentary with some metavolcanic. The slopes can be extremely steep, but there are glacial and alluvial deposits that have gentle slopes or are flat. The predominant species in this zone include Jeffrey pine, Sierra juniper (*Juniperus occidentalis* var. *australis*), quaking aspen (*Populus tremuloides*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and riparian scrubs.

### *Zone 8: East Slope Pinyon–Sage*

This zone is below 2130 m (7,000 ft) elevation. It is entirely outside of the park. The geologic substrate is granitic, metamorphic, and volcanic. The slopes can be extremely steep, but there are glacial and alluvial deposits that have gentle slopes or are flat. Predominant species include pinyon pine (*Pinus monophylla*), antelope bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata* ssp. *tridentata*), snowbrush ceanothus (*Ceanothus velutinus*), and riparian willow scrubs.

Zones VII and VIII include part or all of Twin Lakes, Green Lakes, Buckeye Creek, Virginia Canyon, Lundy Canyon, and Lee Vining Canyon.

## Project Overview

The Yosemite mapping project was initiated in 1996 when NatureServe, Environmental Systems Research Institute (ESRI), Aerial Information Systems, Inc. (AIS), NPS, and USGS met to discuss the use of Yosemite as a pilot for the recently formed USGS-NPS Vegetation Mapping Program (Appendix A). Yosemite was to become the first large national park (defined as any park over 60,700 ha [150,000 acres]) (USGS, 1994) to be mapped. AIS had been subcontracted by the prime contractor, ESRI, to perform the vegetation photointerpretation and automation for YOSE and its environs. Following the precedent of earlier pilots, staff at Yosemite identified a study area boundary (the environs) that would encompass adjacent ecosystems and provide support for cross boundary ecosystem management.

The principal issues at hand for this first mapping project at a large park were the following:

- To implement a geographic information system (GIS)-based gradient-directed transect (gradsect) approach for sampling.
- To integrate the vegetation sampling process with the photointerpretation process so a seamless, mutually beneficial feedback loop would develop with the field crews providing information to the mappers while, at the same time, the mappers supporting decisions by the field crews about where and what to sample.
- To integrate a large amount of existing vegetation data that had been collected since the 1930s with new field data to be collected during this project into a unified vegetation classification that would be used for the final products.

Following initial planning and a contract to acquire aerial photography (1997), the project proceeded to the data collection phase. Staff ecologists with the USGS at Yosemite National Park along with staff from NatureServe and NatureServe's cooperating California State Heritage Program at California Department of Fish and Game supervised field crews in conducting the field sampling effort in 1998 and 1999. The field effort was designed to support development of a vegetation classification in alignment with the U.S. National Vegetation Classification (USNVC), to provide feedback for the photointerpreters, and to assess the accuracy of the cartographic map products. The field data collection phase also included four week long reconnaissance trips involving photointerpreters and ecologists and field identification of preliminary photo delineations.

The photointerpretation and automation phase for the Yosemite project was completed between 2000 and 2002, and the accuracy assessment data collection phase took place from 2002 to 2003. Accuracy assessment data were analyzed and the map finalized in 2006 with reporting completed in 2007.

# Methods

We developed a preliminary vegetation classification from existing datasets, published treatments, and local knowledge in 1997. A gradsect analysis was then completed in order to distribute the field sampling effort among the 566,562 ha (1.4 million acres) encompassing the park and its environs. A two year field sampling effort followed. Simultaneously, photointerpreters delineated approximately 350 photos, which further guided the field sampling effort during the second season. Existing data sets and newly collected field samples then contributed to the drafting of a vegetation classification for the park and environs. Informed by ecological plot data, field reconnaissance efforts, and field verification of pilot study areas, photointerpreters delineated the remaining 1,300 photographs. AIS then used technical procedures to convert the hand-drafted vegetation map units to a georeferenced digital format rectified to DOQQs. Finally, park staff implemented a two year accuracy assessment data collection effort, worked with the USGS ecologist to analyze the data, and collaborated with the photointerpreters to revise the map to meet accuracy assessment goals.

## Vegetation Sampling and Classification

### *Development of the Preliminary Classification*

Before any work began on the map, the California ecologists for the project Todd Keeler–Wolf (NatureServe/California Heritage) and Peggy Moore (USGS) developed a preliminary classification. This was needed to drive the field sampling effort (e.g., approximately how many field samples were to be collected, etc.) and to determine the effort needed for the photointerpretation of the vegetation polygons (i.e., how many mapping units should be used and were those mapping units directly interpretable from the vegetation classification).

In 1997, the ecologists assembled the preliminary classification for the mapping area using the existing California vegetation classification (Sawyer and Keeler–Wolf 1995), a classification of upper montane forests (Potter, 1994, 1998), and other references in conjunction with the local knowledge of vegetation ecologists at the park. In the process, the classification was refined to comply with National Vegetation Classification standard (FGDC 1997). The working preliminary classification together with the expected distribution of types across major environmental gradients were used to prioritize plot collection. In addition to the approximately 300 existing classification units (alliances and associations) gleaned from the literature, 63 preliminary classification units were added by USGS ecologists to account for unquantified variations in the Yosemite classification.

### *Integration of Existing Data Sets*

An extensive amount of data had already been collected on the vegetation of the Yosemite area before this mapping project began. These included three separate sets collected for different purposes, using different methods. One of the principle goals of this pilot project to map and classify the vegetation of this large park was to determine how well the existing data could be integrated into the classification. To better understand the amount of field effort needed to round out the classification, the number of existing data plots likely to represent different vegetation types needed to be determined. The ecologists thus spent much time evaluating the existing data sets and assigning each of the existing plots with an attribute based on the preliminary classification. The following briefly describes the data sets.

## Wieslander Data

Data that were collected by field crews in association with the state wide Vegetation Type Mapping (VTM) project (and named for the state project leader, Albert E. Wieslander) amounted to 754 field plots from Yosemite National Park. These were collected between 1935–1937 and therefore provide a valuable historic reference for the vegetation as it occurred shortly after the inception of fire suppression throughout the Sierra Nevada. Data included 0.1-acre plots for trees and shrubs with brief notes on understory herbaceous species. For a full description of the VTM project and methods, see Wieslander (1935). Generally the woody vegetation of the mapping area was thoroughly addressed by this effort and as a result many of the forest and woodland vegetation types were well represented in the Wieslander data. However, Wieslander samples tended to underrepresent herbaceous vegetation and vegetation with small average stand sizes.

In an independent effort prior to this mapping project, USGS staff at the Yosemite Field Station had transcribed the original data sheets and entered these data into a relational database. Because these data were derived from measurements of diameter and focused on trees and shrubs rather than on grasses and herbs, they were not as useful for full classification of vegetation as stands that contained information on important diagnostic herbaceous species. The locations of these data were entered using township, range, section, and quarter section coordinates. These locations were later converted to the Universal Transverse Mercator (UTM) Zone 11 projection as accurately as possible in the Yosemite National Park GIS system.

To make the data set more useful for classification algorithms, the tree, shrub, and existing herb data were converted from initial cover measurements to cover classes. Three cover classes were used. They are as follows:

Cover class 1—from 1–5% absolute cover
Cover class 2—from 5–25% absolute cover
Cover class 3—greater than 25% absolute cover

## Natural Resources Inventory (NRI) Data

From 1988 to 1993 NPS field crews established 362 plots throughout Yosemite National Park using a stratified random selection of classes in a classified satellite image to locate sample points (J. W. van Wagtendonk, USGS, unpublished plot data). Only areas within the national park boundary were sampled. These data were originally collected to help validate a LANDSAT satellite based vegetation map that was completed using 1930s data for floristic composition and satellite imagery for canopy density. Complete species data were collected with information on tree, shrub, and herbaceous layers collected in different ways. Tree abundance was estimated using diameter at breast height (DBH) measurements. Line intercept transects were used for shrub cover estimates, and small subplots located along transect lines were used for herbaceous cover. Botanists also recorded the presence of any additional species occurring in plots. Appendix D contains a description of this data set as summarized for classifying the vegetation. All data for these samples were entered into a MS Access database and converted to generalized cover classes. The cover classes for trees were based on algorithms for diameter and crown relationships (quadratic mean diameter models) for trees and cover classes for shrubs and herbs were based on the expansion of estimates of cover in transects and subplots. A three-point cover class system identical to the one used for the Wieslander data (see above) was used to run the

classification algorithms. In general the absolute cover values for trees tended to be low but were estimated to fall within the broad cover classes fairly reliably.

U.S. Forest Service Upland and Riparian Classification Plots (Potter)

Don Potter, Southern Sierra Province ecologist for the U.S. Forest Service (located at Stanislaus National Forest, Sonora, California), collected a number of plots in the mapping environs that had not been formally analyzed and described in his publications (Potter, 1994, 1998). He shared these plot data with the classification team in addition to preliminary association descriptions and results from riparian data sets collected primarily in the central and southern Sierra Nevada (Potter, 2000). The plot data were collected based on 0.1-acre plots (400 $m^2$) collected using standardized USFS methods (Allen 1987). These included estimates of cover for all species of trees, shrubs, and herbs. These were broken into five cover classes that were based on the default settings of Two-way Indicator Species Analysis (TWINSPAN) (Hill 1979), which equate to

| | |
|---|---|
| Class I | merely present–2% |
| Class II | > 2–5% |
| Class III | > 5–10% |
| Class IV | > 10–20% |
| Class V | > 20% cover |

Approximately 159 of Potter's plots were used to help develop the preliminary classification. They included approximately 122 riparian and approximately 47 upland forested plots.

### *Sample Allocation and the Development of the Gradsect*

To develop a vegetation map and classification specific to Yosemite National Park and environs, it was necessary to establish ecological plots to supplement and fill in gaps in the existing data sets. The extreme size and varied terrain of the Yosemite region required carefully locating plots to efficiently capture the full spectrum of vegetation types. A gradsect analysis (Gillison and Brewer 1985) utilizing spatial representations of the environmental variables associated with the region's vegetative diversity was used to help determine plot placement.

In May of 1997 a consortium of USGS, NPS, NatureServe, and California Heritage ecologists familiar with the vegetation of Yosemite chose the environmental variables most responsible for the region's vegetative diversity. These environmental variables were then used to develop a spatial model predictive of potential vegetative diversity. The salient variables were determined to be slope, aspect, elevation, geology, hydrology, the east–west gradient in climate, and fire history. Suitable classes were determined for each of these variables and spatial coverages constructed for each. We then combined the grid coverages to form the initial Biophysical Units (BPUs), which would be used to stratify sampling. A more detailed description of the development of the gradsect is presented in Appendix B.

To maximize efficiency and field crew safety, we developed an approach using a terrain model of the park and environs to derive a cost surface. The cost surface reflected the relative cost of accessing areas in terms of difficulty and safety. We reclassified cells according to their slope, which varied from 3 for flat to 45 for very steep. We eliminated areas with inaccessible boundaries, including permanent water bodies and slopes that were steeper than 45 degrees. Then, using this cost surface in a weighted-distance function with paved roads as the source,

each cell within the environs was assigned a least cost value. A weighted-distance function was then used to help determine plot placement for the 1998 field sampling season.

To most effectively sample vegetation in the 1999 season, ecological sampling focused on unsampled BPUs that presented undefined signatures to the photointerpreters and those that corresponded to types needing additional samples for the classification. Photointerpretation was scheduled to precede the field crews' work in each ecological zone so they would have photos with delineated polygons to direct their sampling. The oak-chaparral ecological zone (Zone I) was first, followed by the California red fir ecological zone (Zone III). Work then focused on the lower east slope and the pinyon-sage ecological zone (Zone VIII). Interpretation progressed steadily upslope as dictated by anticipated weather and plant phenology. The photointerpreters used previously collected plots from the ecological zone and their own field visits with ecologists to train them to recognize distinct vegetation signatures. Unrecognizable signatures and types known to need additional samples for classification were targets of the field crews.

#### *Field Data Collection*

A standardized field data collection protocol was developed in the spring of 1998 as a collaborative effort with the NatureServe senior ecologist and the ecologists for this project. This protocol was relevé based (Mueller-Dombois and Ellenberg 1974:45). Cover of trees, shrubs, and herbaceous species was estimated in plots of variable sizes based on the physiognomy of the vegetation. In general, herb-dominated plots in the patchy alpine and subalpine and in meadows were 100 $m^2$ while scrub and riparian shrubland plots were 400 $m^2$, and large stands of wooded vegetation were sampled with 1,000 $m^2$ plots. A standard set of environmental variables was collected as part of each field sample. All plots were permanently located with markers using Department of Defense grade GPS receivers (PLGR; Rockwell Collins, Inc., Cedar Rapids, Iowa) through a special arrangement for nonfederal access. Rarely, coordinates were derived from a USGS topographic quadrangle map (1:24,000 scale) when satellite availability was poor. A complete description of the field sampling protocol and the field data sheets and code lists are provided in Appendix D.

The field coordinator specified where flowering phenology was approaching optimum sampling conditions to ensure the maximum number of species would be identifiable. Maps of these areas were then produced for the field crews. Using USGS orthophoto quarter quadrangles and digital raster graphic topographic quadrangles as backdrops, maps and boundaries of the BPU subset (without photointerpretation labeling) were plotted at 1:12,000 scale. These maps were then used as navigational aids by the vegetation sampling crews. UTM coordinates for each BPU were given in a table printed on the map margin. A small graphic of the environs with the boundaries of the mapped area was also plotted on the margin.

The field crews who performed the data collection for the 1998 field season were trained in early June, and, through the months of June, July, and August 1998, they collected data from 264 field plots. In the 1999 field season, crews were trained in early May and collected data through the early part of September. In 1999, data from 340 field plots were collected.

### Archiving and Analysis of Data

The NatureServe–NPS PLOTS database (NatureServe, 1997), based on MS Access 2.0 software, was used to enter and archive all field data collected in the sampling seasons of 1998 and 1999.

This database was developed specifically for the NPS mapping projects, and data entry mirrored the field forms used in the project (see Appendix D for field forms and field protocol). Data were entered by NatureServe contractors on-site in the summer of 1998 and by NatureServe staff at the Midwestern Resource Office in Minneapolis, Minnesota, following the 1999 field season. Data were quality controlled by NatureServe ecologists in Minnesota. The plot numbers of the data sets were coded based on the year collected (prefix of 98 or 99), the field team leader's last name (K = Klohr, M = Martin, S = Singer), and a number. For example, 99K125 would be the 125th field sample collected by the Klohr field crew in the 1999 field season. As mentioned previously, the Wieslander data set, the Potter data set, and the NRI data set were all entered individually into Microsoft Access databases and/or Excel spreadsheets. The NatureServe data set is available through the vegetation plot database of the Ecological Society of America's Panel on Vegetation Classification (www.vegbank.org). Photographs taken of each plot are archived with the original field data at Yosemite National Park.

### *Classification*

We used standard techniques to analyze ecological plot data and identify types for the vegetation classification of Yosemite National Park and environs. Details on the development of the classification are available in Appendix C. The classification presented here is based on the 1997 version of the USNVC hierarchy (Grossman et al., 1998). A conservative approach was taken to the formation and other upper levels of the classification in keeping with revisions of the national hierarchy at the time. That is, a modal formation for an alliance was selected rather than developing multiple formations and alliances for groups such as hydrologic variations or variations in canopy density, which may force an otherwise ecologically homogeneous alliance into multiple alliances or formations. For example, Sierra lodgepole pine associations were placed under a single alliance rather than into separate forest and woodland alliances based on canopy density. We were conservative about type names and retained original author's name for a type even if it did not follow alliance name order (e.g., *Abies concolor-Pinus lambertiana-Abies magnifica* Forest of Potter (1998) in the *Abies magnifica-Abies concolor* Alliance).

### *Key and Description Writing*

The vegetation key is written from two perspectives: (1) a field team attempting to identify vegetation or (2) an office team attempting to place field-collected samples into the proper category. Thus, heavy reliance is placed on correct identification of characteristic plant species and of proper estimation of vegetative cover of these species (see the instructions for following the key in Appendix J, the key to vegetation types, for specific instructions and definitions of terms used).

Following the analysis of the plot data and the development of the key and classification, we wrote descriptions using the currently available template provided by NatureServe. The two primary writers were Michael Schindel (The Nature Conservancy, Oregon Field Office) and Sau San (California Native Plant Society). Diana Hickson (California Heritage) and Peggy Moore (USGS) each wrote several descriptions. Todd Keeler–Wolf (California Heritage) also wrote several descriptions and edited all of the descriptions.

When writing the descriptions the following standards were set.

**Characteristic/Diagnostic species:** These species must occur in at least 80 percent of the plots.

**Minimum sample size for description:** n = 3. Descriptions of associations with fewer than three samples were attempted if (a) the association was sampled and described by previous authors or (b) the vegetation was confirmed as distinctive and repeatable based on field reconnaissance or by photointerpretation signature.

**Abundant species:** Species that were present on at least 50 percent of the plots at an average of at least 30 percent relative cover on all plots.

Brief alliance descriptions were included when there was a substantial number of polygons mapped in the study area but where no mapping unit description was available. Association and brief alliance descriptions are available in Appendix K.

### *Vegetation Type Naming Conventions*

Nomenclatural conventions follow, to the extent possible, the 2008 National Vegetation Classification Standard of the Federal Geographic Data Committee (FGDC 2008:38). This standard includes the following:

- Community nomenclature must contain both scientific and English common names.
- Nomenclature for vascular plant taxa used in scientific type names should follow the accepted name in USDA PLANTS (http://plants.usda.gov) or the Integrated Taxonomic Information System (ITIS) (www.itis.gov).
- Among the taxa that are chosen to name the type, those occurring in the same stratum or growth form (tree, shrub, herb, nonvascular, floating, submerged) are separated by a hyphen ( - ), and those occurring in different strata are separated by a slash ( / ). Diagnostic taxa occurring in the uppermost stratum are listed first, followed successively by those in lower strata. The order of taxon names within a stratum or growth form generally reflects decreasing levels of dominance, constancy, or other measures of diagnostic value.
- Association or alliance names include the name of the level of the hierarchy in which the unit is placed, e.g. *Pinus ponderosa* Forest Alliance in headings or *Pinus ponderosa* forest alliance within text.
- In cases where diagnostic taxa are unknown or in question, a more general term is currently allowed as a “placeholder” (Jennings et al. 2009) (e.g., *Cephalanthus occidentalis* / *Carex* spp. northern shrubland).

In this report and classification, the source used for English as well as scientific names of species is the ITIS. Synonyms from Hickman (1993) are shown parenthetically where they differ.

In addition, capitalization rules for describing vegetation have been adopted as follows:

- When a common name for a vegetation type is being used in a table, heading, or list, each word is capitalized (except for the second word in a hyphenated word, such as Incense-cedar), e.g., Sierra Lodgepole Pine Woodland.
- When a Latin name for a vegetation type is being used as a heading or a label, each word is capitalized except for the specific epithet of Latin names, e.g., *Pinus contorta* var.

*murrayana* Woodland, and the rank (e.g., ssp., var., or forma). Latin names in a vegetation type are italicized in print to follow normal rules of style.

- When a common or Latin name of a vegetation type is being used in a sentence, as in the description of the type, only the Latin names of genera and proper or place names are capitalized (as in standard conventions for Latin and common names of plants), e.g., *Pinus contorta* var. *murrayana* woodland …, or Sierra lodgepole pine woodland ….

### *Relationship between Vegetation Classification and Mapping Classification*

USGS ecologists along with vegetation ecologists from the CA Department of Fish & Game (DFG), Natural Heritage worked closely with photointerpreters from AIS to develop an initial mapping classification based on the preliminary floristic classification and the four one-week reconnaissance efforts undertaken in April through August of 1999. This effort allowed for consistency in the development of the mapping classification and a successful nesting of that classification within the floristic hierarchy.

The mapping classification for YOSE and environs is a summary of photo interpretable classes encompassing a wide range of types which for the most part fall within the hierarchy of the floristic classification. The mapping classification contains floristically and ecologically defined types, which are listed under the following categories:

- Phases: Several mapping types represent higher levels of detail than are described in the association level definitions described in the USNVC.
- Associations: Direct correlation to associations in the USNVC.
- Superassociations: Represents groups of associations within an alliance which share floristic and environmental similarities such as the Sierra lodgepole pine forest mesic superassociation (mapping code 3048). Other terms for the superassociation include suballiance and association groups.
- Alliances: Direct correlation to alliances in the USNVC.
- Superalliances: At YOSE, several mapping types must be generalized to this level where two alliances occupying similar environments are grouped together because they are not separable on the aerial photography. White alder and bigleaf maple superalliance (mapping code 2520) is an example of a mapping Superalliance.
- Mapping Units: These are types that range in detail and do not nest perfectly between any of the categories defined in the USNVC. One example of a mapping unit may include species from two different associations, which technically fall in separate alliances but hold together through similar ecological and floristic characteristics. Sierra lodgepole pine-quaking aspen-(Jeffrey pine) forest mapping unit (mapping code 3011) is an example of a mapping unit. Another more general example of a mapping unit may be a habitat-derived category such as the silver lupine-brome grasses shrubland mapping unit (mapping code 5250). In this type, photointerpreters do not often see the sparse lupine shrubs, but recognize the steep, rocky habitat in which they are most often observed in the field. Other examples of mapping units include aggregations of meadow vegetation defined by their flooding regimes. Willow aggregations comprising several species in one stand also fits the definition of a mapping unit and is separated out at Yosemite based on zone and habitat (meadow-talus-riparian).

## Photointerpretation and Mapping

### *Project Materials*

The following materials were used for the YOSE mapping project.

- Aerial Imagery (hardcopy stereo-pair diapositives & prints): The aerial imagery was flown in August of 1997 for the park and its environs at a scale of approximately 1:15,860. They were used as the base for the vegetation photointerpretations and attribute coding. There are 1,667 23 cm x 23 cm (9 in x 9 in) photos that were created from the overflight and photointerpreted.
- Digital Orthophoto Quarter Quadrangle (DOQQ) Basemap: Digital orthophoto quarter quadrangles (DOQQs) served as the base for the data rectification task. The data rectification task is discussed later in this document in the Data Conversion section. The park did not have a full set of DOQQs that covered the study area, so two different sets of DOQQ imagery were used. The date range of the DOQQs was 1987 to 1999 and they were in either a color infra-red (CIR) or black and white format. For a complete list of the DOQQs used, refer to Appendix G in this report.
- Total Number of DOQQs: 182 (all or in part)
- Total Number of USGS 7.5 Quads: 43

### *Photointerpretation Mapping Procedures*

There were four major tasks associated with the photointerpretation phase of the YOSE vegetation mapping project:

- Field reconnaissance
- Field plot sampling & mapping classification development
- Photointerpretation of vegetation
- Field verification

AIS conducted the photointerpretation and data conversion efforts. Field reconnaissance and verification efforts were performed jointly by AIS photointerpreters along with USGS and NatureServe ecologists. NatureServe staff performed the field plot sampling and subsequent analysis leading to the development of the floristic classification. NatureServe field biologists and park staff collected accuracy assessment data and created the final accuracy assessment database.

<u>Field Reconnaissance</u>

AIS photointerpreters, accompanied by state and USGS ecologists with local expertise, visited eight defined ecological zones during four one-week reconnaissance trips during the 1999 field season. Each reconnaissance effort entailed visiting two adjacent ecological zones; lower elevation zones were visited early in the season while the alpine zones were assessed toward the end of the field season in late summer. The following is a brief summary of each of the four reconnaissance efforts conducted during the 1999 field season:

Zones 1 & 2: Accomplished in mid April, this reconnaissance was geared towards lower elevation oak woodlands and chaparrals, in addition to major riparian zones of the low elevations. Photointerpreters were tasked to gather signature and related environmental correlates between blue oak and interior live oak and between canyon live oak and interior live oak at the higher elevations. Photointerpreters also viewed low-elevation chaparral, in addition to low-elevation conifers including knobcone pine (*Pinus attenuata*) and gray pine types. Specific sites visited included Cherry Lake Reservoir, Hetch Hetchy Reservoir, and the Merced River canyon.

Zones 7 & 8: Following the progression of the onset of spring growth, photointerpreters visited the high desert fringe along the east slope of the range in early May to acquire signatures and environmental parameters on a variety of conifer woodland, riparian types, and desert edge communities, including pinyon pine and sagebrush shrubland. Photointerpreters had limited access to the higher elevations in the adjacent zone 7 but, due to the extremely steep setting, were able to view numerous high-elevation stands from elevations immediately downslope. Specific sites visited included Grant Lake, Lee Vining Creek, Virginia Lakes, Twin Lakes and Buckeye Flats.

Zones 3 & 4: Photointerpreters visited higher elevation mixed conifer regions in July to acquire the subtle signature differences between the various mixed conifer types found in these zones. Extremely difficult and confusing signature correlates had to be separated out between California red fir and white fir communities, in addition to the over 15 different mapping types later defined within the Sierra lodepole pine alliance. Photointerpreters also visited areas containing a mix of different montane chaparral communities in both post-fire settings and rocky environments in addition to a variety of meadow and riparian habitats. Specific sites visited included the Wawona area in the southern portion of the park, Crane Flat, Glacier Point Road, and points along Tioga Pass Road from Crane Flat to Tenaya Lake.

Zones 5 & 6: During August of 1999, photointerpreters accompanied NatureServe and USGS ecologists for one last visit to the alpine and subalpine types along the Sierra Nevada crest to gather signature differences between the high elevation conifer communities and associated meadow, talus and scree sites above 9000'. Of particular concern was the photointerpreter's challenge to tease out signature and environmental correlates between whitebark pine and Sierra lodgepole pine types, in addition to high elevation mountain hemlock stands. Photointerpreters and ecologists also devised a method for potentially separating out small vegetation communities growing on talus and scree sites by separating out these communities based on their slope related characteristics. Specific sites visited included Gaylor Peak; Tioga, Mono, and Parker passes; and Tuolumne Meadows.

### Mapping Classification Development

During the latter portion of the 1999 field season, AIS provided 350 hard copy overlays of photo delineations to the field crews to assist in PI signature refinement and the development of a final list of types to be mapped. AIS helped ascertain whether or not there were any remaining vegetation types not yet sampled. Specific delineations provided to the field crews were correlated to unsampled biophysical units (BPU) created in the gradsect process to help clarify areas where the field crews still needed to sample.

During several weeks in the fall of 1999, one field crew person (Cristian Singer) was assigned the task of addressing specific questions from the photointerpretation team at AIS. This aided photointerpreters in establishing a final set of PI-to-ground correlates in areas where photo signature questions remained unresolved.

From these initial photo delineations, the four-week reconnaissance effort, the review of existing plot data, and the 1998-1999 field sampling, AIS photointerpreters developed a preliminary mapping classification and set of descriptions which underwent review by both local USGS and state ecologists. Final mapping classifications and descriptions are the result of these efforts, and the subsequent aggregations of mapping classes are based on the results of the accuracy assessment.

### Photointerpretation of Vegetation

During the photointerpretation process, we identified map units based on their photo signatures. We defined these signatures by their color, texture, tone, and pattern on the aerial photography. By observing the context and extent of the photo signatures associated with specific vegetation types, photointerpreters identified and delineated boundaries between plant communities or signature units. Environmental factors such as elevation, slope, and aspect also contributed to the photointerpretation decision-making process.

Each photo was prepared with a 23 cm x 23 cm (9 in x 9 in) frosted mylar overlay for the photo signature delineations. Photo overlays were pin-registered to the photos and project labels were affixed to each overlay identifying the photo number, status of work, and photointerpreter responsible for that task. Study area boundaries were drafted onto each photo overlay, defining the area within the photograph to be interpreted. The study area boundaries were edge matched to adjacent photos to ensure complete coverage.

Understanding the relationship between the vegetation units and the environmental context in which they appeared was useful in the interpretation process. To this end, photointerpreters made use of additional collateral sources (existing vegetation maps, supplemental photography, soil data, plot data, etc.). Prior to the PI effort on each photo, these ancillary data were added to the mylar overlay by photointerpreters in order to document all locations and information within the study area on an aerial photograph. In addition to NRI, USFS, and NatureServe ecological plot data, ancillary data also included data from 57 ecological plots collected within DEPO in 2000 to assist with vegetation mapping.

Using a mirrored stereoscope with a 3X lens, photo signature units were delineated onto the mylar overlays. These initial photo delineations were based on a number of signature characteristics including color, tone, texture, relative height, and density. Attribute codes (e.g., mapping classification types, canopy density) were assigned to each polygon and annotated onto the mylar overlay. The map units and codes were edge matched to the adjoining photo overlays.

Land use activities within the park units were also identified during the mapping of the vegetation units. Land use was indicated by coding the PI field as Urban/Developed (code 0990), while a detailed modified Anderson et al. (1976) level 3 classification was assigned to the land use attribute field. AIS received collateral information on land use from the park to help facilitate

the land use mapping in areas around the Yosemite Valley. The list of land use categories assigned to polygons in the land use attribute field is available in Appendix R.

*Minimum Mapping Unit*

Every effort was made to conform to the 0.5 ha minimum mapping unit standard and, in areas of special concern, such as wetland meadows, to exceed it by mapping at a finer scale. In some settings where extensive gradients existed between two vegetation types, it was not possible to adhere literally to the minimum mapping unit and therefore larger inclusions of very similar types may be found within mapped polygons, particularly toward polygon edges. For example, we did not separate small polygons of pure California red fir within large polygons of California red fir-Sierra lodgepole pine forests unless they followed a unique and continuous environmental change such as a drainage or concavity within the stand.

*Positional Accuracy*

We registered and rectified the photointerpreted line work to published USGS digital orthophoto quadrangles (DOQs) to match the positional accuracy of the DOQs. DOQs produced by USGS and/or its contractors are designed and tested to meet national map accuracy standards for 1:12,000-scale products.

*Aggregation*

Aggregation of multiple vegetative classes is necessary when vegetation types present within a polygon fall below the resolution of the minimum mapping unit of 0.5 ha. The following aggregation rules were followed when mapping vegetation for this project:

- Similar life forms were aggregated together; tree dominated types were aggregated with other tree dominated types, shrub types with other shrub types and herbaceous types with other herbaceous vegetation types.
- If possible, wetland vegetation types generally were not aggregated with upland types, even if they were in the same life form.
- If a unit that is below minimum mapping resolution was completely surrounded by another vegetation type, the unit was aggregated with the surrounding vegetation.

*Density*

Density, also referred to as vegetative cover, is a quantitative estimate of plant cover derived from viewing the aerial photography in stereo magnification. Photointerpreters assessed the total density of vegetation associated with the life form of the alliance being assigned to that polygon. For example, if the polygon was defined as a Jeffrey pine/greenleaf manzanita association, only the tree cover was evaluated in calculating a density value. If the polygon was defined as a greenleaf manzanita alliance, only the shrub cover was evaluated, not any emergent tree layer.

Photointerpreters used six categories to define density or vegetative cover:

1 = Greater than 60%
2 = 40-60%
3 = 25-40%
4 = 10-25%

5 = 2-10 %
6 = Trace amounts less than 2% (used for talus & scree)

It is important to note that photointerpreters can only accurately quantify the vegetation that is visible on the aerial photography. Using aerial photography at scales smaller than about 1:12,000 (the YOSE aerial photography scale is approximately 1:15,860), photointerpreters generally cannot see the amount of vegetation which is obscured by a higher canopy, regardless of its life form; therefore, total vegetative cover may differ from assessments done on the ground by field crews. Understory vegetation that is not visible on the aerial photograph cannot be quantified when assigning the total cover of vegetation for that polygon.

*Density Mapping Criteria*

- Photointerpreters formed separate polygons when there were changes from one density class to another within a vegetation type or mapping unit at a scale greater than the minimum mapping unit of 0.5 ha. For example, two adjacent polygons may have the same vegetation type assigned (e.g., 1022, canyon live oak/whiteleaf manzanita forest) but different density categories (e.g., 25-40% versus 10-25%).
- To determine the density or vegetative cover, photointerpreters assigned percentages to the different life forms visible on the aerial photo, including non-vegetated areas. The total percent cover of trees, shrubs, herbaceous and non-vegetated should add up to 100%. The density percentages were then converted into the appropriate density category.
- Non-vegetated areas were not coded in the database unless they met the minimum mapping resolution for the park and could be mapped as stand-alone polygons. Otherwise, it was assumed that all vegetation polygons contained non-vegetated areas.
- The photointerpreters considered the coverage pattern of the life form before assigning a density code to the polygon. Estimating densities was more straightforward when plants occupying the same strata (or vegetative layer, e.g., tree, shrub, herb strata) were evenly distributed throughout the polygon. However, when polygons contained populations of plants that were clumped or occurring only in portions of the polygon, the photointerpreter also considered the area that was not occupied by plant cover when determining total density. To ensure consistency, it was helpful to count the plants in polygons with clumped and unevenly distributed vegetation and then to compare them to similar sized polygons with an even distribution of plant cover.
- Vegetation stature and the scale of the aerial photography determine the visibility of individual plants. Trees are usually visible as individuals, and, with larger scale photography, so are shrubs. However, grasses are rarely seen as individual plants, regardless of the scale of the photography.
- In the case of trees and shrubs, the percent cover at a density break was adjusted downward. If the percent cover was at about 25%, the polygon was assigned a density category of sparse (10-25%) instead of dispersed (25-40%).
- Dry grasses tend to be less dense than they appear on the aerial photography. To more accurately depict the densities, the percent cover for dry grasses was adjusted downward. In particular, if the percent cover fell at the lower end of a density class, the polygon was

assigned the next density class down. For example, if the percent cover was 25%, the polygon was assigned a density category of sparse (10-25%) instead of dispersed (25-40%).

- The date that the aerial photography is acquired also influences the density assigned to vegetation types, particularly for herbaceous dominated vegetation types. Subsequent field verification and accuracy assessments must take into consideration the following factors that can cause apparent discrepancies between the densities evident on the photo and those visible in the field:
    - Seasonality - The density of most herbaceous plants is variable due to their annual growth cycle. Depending on the season the aerial photography was taken, a mapped unit could show a different density on the aerial photographs than is observed during an on-site visit at a different time of the year. Another effect of seasonality is leaf on/off conditions. Photos of forest or woodland areas with leaf on conditions obscure the understory. Photos of leaf off conditions would allow photointerpretation of the understory, but make it difficult to identify the overstory species since there is no foliage present.
    - Annual variability - The environmental conditions at the time of the photography (wet vs. drought years, flooding, etc.) may affect the densities seen during the on-site field visits.

*Fire Severity Modifier*

Since the Park had a special interest in mapping the areas where recent fires have occurred, AIS mapped a fire severity modifier for each polygon. The following criteria were used when mapping fire severity:

- The fire history coverage provided by the Park acted as a starting point for assigning the fire severity modifier to the vegetation polygons.
- Fire severity modifiers were assigned to vegetation polygons within burned areas that were identified by the fire history coverage output as 5 years old or less.
- If, when photo interpreting, there was evidence of recent burn, such as char marks or standing dead trees, then a fire severity modifier was assigned to the vegetation polygon.
- All vegetation polygons that were assigned a fire severity modifier were also assigned a vegetation class.

The categories and descriptions for the fire severity classes were as follows:

- 1 = High Severity: The vegetation polygon fell within the 5 year history and there was 0 to 10% of the original vegetation remaining.
- 2 = Moderate Severity: The vegetation polygon fell within the 5 year history and there was 10 to 50% of the original vegetation remaining.
- 3 = Low Severity: The vegetation polygon fell within the 5 year history and there was 50 to 90% of the original vegetation remaining.

- 9 = No Modifier: Either the vegetation polygon did not fall within a fire history of 5 years or less or the vegetation polygon did fall within the 5-year fire history and there was 90 to 100% of the original vegetation remaining.

In areas of fire history that were 6 to 10 years old, where the vegetation could not be mapped to the association level, the alliance level was mapped.

Quality Control of the Photointerpretations

A separate quality control step was performed for each photo upon completion of the photointerpretation. A senior photointerpreter reviewed each photo for map unit delineation, PI signature code, and canopy density code accuracy. Each photo overlay was checked for completeness, consistency, and adherence to the mapping criteria and guidelines. Photos were also reviewed for edge consistency both along and between the flight lines.

Field Verification for the Pilot Study Areas: A Park Based Interim Data Verification Effort

Prior to broad-scale mapping, the intended mapping approach was reviewed in pilot study areas. Four areas were selected by the National Park Service in November of 2000 in which AIS was to complete the final photointerpretation and automation procedures (see below regarding automation). The maps were reviewed to determine if adjustments in the classification (both floristic and mapping) were needed and to determine whether proposed mapping procedures needed realignment. The following is a list of the four pilot areas:

1. El Portal – An area along the Merced River including the town of El Portal and associated low elevation chaparral and oak woodland communities.
2. Yosemite Valley – A portion of the Yosemite Valley encompassing lower mixed conifer woodlands and steep side-slope vegetation adjacent to the valley floor.
3. Glacier Point – An upper mixed conifer region including Glacier Point and surrounding mixed fir and Sierra lodgepole pine forests to the south.
4. Devils Postpile – Including the actual Postpile and adjacent areas both to the north and south along the Middle Fork of the San Joaquin River.

Overall, photointerpretation corresponded well at the alliance level to vegetation observed in the field in most categories except in some of the mixed conifer zones in the Glacier Point and Devils Postpile areas. Questions arose in several polygons where California red fir dominated higher elevation portions and white fir was more common in lower portions. We determined in these instances that the polygons could not be divided reliably since the existing polygons were already less than about 2 ha (5 acres) in size and good portions of the polygons had substantial mixing of the two firs.

Final Verification Effort

Three subsequent field verification efforts were performed in the late fall of 2001 and spring of 2002 in which ecologists from USGS and DFG accompanied photointerpreters to check for major errors in the labeling of the polygons. Alliance level accuracy for the most part appeared successful, with predictable confusion in several of the more detailed association level efforts in all major zones. We agreed that no aggregations would be made until the final results of the accuracy assessment were evaluated. Listed below is a brief analysis of specific problem areas noted in the three verification efforts completed by AIS in the 2001 and 2002 seasons:

- Zones 1 & 2 – December 2001: We observed specific mapping problems between the white fir and white fir-mixed conifer types and identified potential candidates for mapping class aggregations.
- Zones 3 & 4 – June 2002: Confusion arose where Sierra lodgepole pine was an important conifer component over a variety of montane chaparral species, which did not at the time fit any type in the mapping or floristic classification. Photointerpreters used the montane chaparral understory as a guideline for assuming a presence of western white pine in the stand and thus changed the coding for several of these visited stands to type 4069, California red fir-western white pine with a montane chaparral understory.
- Zones 7 & 8 – September 2002: Higher elevation stands of whitebark pine were observed growing over a dense herbaceous understory of needlegrass (*Achnatherum* sp.) bunch grasses which the photointerpreters mapped as whitebark pine over shorthair sedge (*Carex exserta*; mapping code 3144). This was believed by ecologists to be an east slope anomaly where stands of whitebark pine were growing in a somewhat drier environment than the subalpine stands containing a shorthair sedge understory.
- Zones 5 & 6: No verification effort was done for alpine scree and talus or meadow areas since, at the time, no accuracy assessment for these types was planned.

### *Data Conversion*

Once it had been verified that the pilot study areas were of high enough accuracy to continue with the overall map development, data automation could take place. The following section outlines the data automation procedures required to convert the hand-drafted vegetation map units to a digital format rectified to the DOQQ base. For a list of the digital orthophoto quadrangle names, see Appendix G.

#### Data Automation

Data automation was conducted using Mono Digitizing Stereo Digitizing (MDSD, Carto Instruments Incorporated, Seattle, WA) software. The MDSD software was used to capture the vegetation linework and automatically georeference the data into real-world coordinates. The first step of the procedure involves the creation of control points. Control points are corresponding locational points that are identified both on the DOQQ imagery and the aerial photography and input into an ARC/INFO (Environmental Systems Research Institute, Inc., Redlands, CA) point coverage.

By using the control points generated in the previous step, each photo was registered to the DOQQ. Once each photo was georeferenced, the lines were then digitized. The digitized lines were stored in a MDSD outfile format that were then converted to a coverage using ARC/INFO.

#### Data Rectification

Coverage linework from each aerial photo was rectified to the corresponding DOQQ. That is, the DOQQs served as the base imagery for positional accuracy of interpreted vegetation polygons. The coverage, containing polygons and codes, was checked for open polygons, data registration, and any spatial edge-match problems among photos. Registration quality depends on the accuracy, quantity, and distribution of the control points. Spatial refinement was performed in ARCEDIT sessions using various user-defined tools. Lines depicting boundaries representing

minimal ecotones (for example – land use interface, water bodies, life-form interface) were refined.

Polygon Attribute Assignment

During the data rectification step, label points were created and coded for each map unit. The vegetation mapping type, density, land use, and any other attribute codes were input for each polygon (see Appendix H for mapping classification including codes for vegetation mapping types). Automated quality control measures that AIS created, such as Codecheck and code frequency programs, were run to check for code validity.

Code Verification and Edit Plot Quality Assurance

A hard copy edit plot of the converted spatial data was produced for each DOQQ and compared to the aerial photo overlays. Each plot was checked for cartographic quality of the arcs defining the polygon features and the accuracy of the label assignments. Line and code corrections were noted directly on the edit plot. All plots were edge matched to verify line and code accuracy across map sheets, and corrections to the coverages were made as needed.

Final Quality Assurance of the Vegetation Map

The individual coverages created for each DOQQ were then joined into a single seamless vegetation coverage for the park unit. This final vegetation layer was examined by a senior photointerpreter. Final checks were conducted to test for invalid codes, missing or extra lines, or edge match problems; to verify the registration of linework to the DOQQ base; and to review the distribution of species mapped within the park.

## Accuracy Assessment

Accuracy assessment (AA) is a comparison of how well polygon mapping class assignments represent vegetation on the ground. The AA compares field observations with the mapping class assignment of the sampled polygon. Results of the AA allow users to evaluate the utility of the vegetation mapping data for particular applications. We collected AA data during the 2002 and 2003 field seasons, when the first photointerpretation products became available.

### *Accuracy Assessment Sample Allocation*

We used a stratified approach to allocate accuracy assessment sampling intensity according to the relative occurrence of mapping classes. The more common the mapping class in terms of polygon number, the greater number of AA points allocated to that class, with a minimum number of points allocated to rare classes. Sample sizes were initially based on guidance from the USGS-NPS Vegetation Mapping Program (ESRI and TNC 1994), but we reduced the sizes based on the large number of mapping classes to be assessed in two field seasons (130) and on budget constraints (Table 2). The number of polygons selected per class was an over selection based on the need for flexibility in planning field work. The over selection allowed us to have a sufficient number of target polygons to maximize efficiency when planning access to remote areas, and it provided for some polygons to be rejected by the field crew due to unsafe conditions.

Table 2. Sample allocation categories for allocating the number of accuracy assessment points by mapping class for the Yosemite National Park vegetation mapping project.

| Number Polygons Within a Mapping Class | Initial Allocation of AA Points | Revised Allocation of AA Points | Number Polygons Selected |
|---|---|---|---|
| > 300 | 30 | 22 | 45 |
| 150-300 | 20 | 15 | 35 |
| 50-149 | 12 | 8 | 24 |
| 15-49 | 5 | 4 | 13 |
| 0-14 | variable | variable | variable |

Classes that tended to be rare and were allocated the fewest AA points included woodlands whose ranges extended to just inside the mapping area (e.g., blue oak, knobcone pine). Classes that tended to be abundant, commonly mapped with larger polygons, and had the largest number of AA points allocated were widespread forest types dominated by, for example, Sierra lodgepole pine, California red fir, and mountain hemlock.

Some non-vegetated or sparsely vegetated classes were not assessed for mapping accuracy. These included alpine talus slopes, alpine boulder field, non-alpine talus, rock outcrops, sparsely vegetated riverine flat, water, and snowfield/glacier. Rather, we focused the field effort where botanical expertise was needed and on the highest priority assessments. Vegetation classes we did not assess included plantation, conifer reproduction, and meadow types. We did not assess meadows for compositional accuracy because they were mapped according to approximate hydrologic regime, not plant assemblages.

Park ecologists provided information on ecologically important types for which reliable accuracy assessment information would be valuable. We ensured these types received point allocations in the higher categories. For example, canyon live oak-ponderosa pine association is favored by spotted owls, and black oak provides important food and cavity resources for many species.

We considered efficiency and accessibility in the selection of sample points to be assessed in the field. Once polygon selection was completed for all mapping types to be assessed, planning for field work logistics included identifying groups of selected polygons of various classes that could be visited in an area or along a route. Some polygons were rejected in the office for safety reasons due to steep slopes or proximity of main highways. Additional polygons were rejected in the field due to unsafe conditions not apparent during advance planning (e.g., high water crossings) or when it became apparent that a polygon fell into a type not being assessed.

We endeavored to select polygons within a mapping class that were dispersed across the geographic range of that class. For instance, for a vegetation type evenly distributed between the Merced River and Tuolumne River canyons, we selected an equal number of polygons from each of the two watersheds. For some vegetation types, the distribution was highly localized, and it was difficult to disperse selected polygons. Although for field work planning we selected polygons in groups or along routes, we avoided selecting polygons of the same type that were in close proximity. Exceptions occurred when there were few accessible polygons from which to choose (due to a type’s preponderance to occur in remote, steep terrain) or when there was a

distinct environmental variable separating the two polygons (e.g. a river with an aspect change). We avoided assessing polygons in anthropogenically disturbed areas, such as campgrounds and housing areas.

### *AA Field Data Collection*

Accuracy assessment for the Yosemite vegetation mapping project was a polygon-based design. That is, AA data were recorded for the polygon as a whole rather than at the minimum mapping unit or plot scale. Field crews used multiple navigational tools to locate polygons to be assessed, including photointerpreted line work, but assessments were done blind, that is, without access to polygon attributes.

We hired field crews with botanical expertise and, whenever possible, familiarity with the Sierra Nevada flora. We trained them in the use of the floristic key to associations and in the recognition of plant communities and dominant and indicator species in the field. We also trained crews in discerning dominant vegetation types within polygons with variable canopy density and relative cover. They learned to assess polygons for homogeneity, to evaluate the representativeness of the target AA coordinate, and to identify inclusions of other plant communities within otherwise homogeneous composition and structure.

Crews used global positioning navigation and orienteering to locate target AA points and identify the polygon of interest. Navigational tools included global positioning receivers, orthophotos, AA point UTM coordinates, and maps of polygon lines over digital raster graphs (DRGs). The crew surveyed medium and small polygons over most or all of the polygon extent whenever possible. For large polygons, they evaluated as much of the polygon as feasible, recorded the approximate proportion of the polygon evaluated, and recorded data from a representative portion of the polygon. They considered the modal expression of the overall polygon when assigning primary and secondary vegetation association names. They recorded information and collected GPS coordinate data at the target coordinate (i.e., polygon centroid) or at the most representative point within the polygon. They avoided collecting data from non-representative areas or inclusions. Non-representative areas had atypical species composition or structure compared with the majority of the polygon. Inclusions were areas within the sampled polygons with plant associations or alliances that distinctly differed from the majority of the polygon but were smaller than the minimum mapping unit of 0.5 ha.

In very rugged terrain (most common at the lowest elevations of Zone 1), field crews made some assessments remotely. These were limited to the 21 vegetation types identified by project ecologists as those with indicator species that could be identified remotely (e.g., blue oak, gray pine, knobcone pine, and chamise types). Crews generated data collection points for these polygons by using the GPS to “offset” the point from a vantage point with good views of the polygon and recorded the offset vector associated with the AA point coordinate.

Field crews recorded and tracked data by unique AA observation codes paired with unique numeric polygon codes. Environmental data collected in the field included elevation, slope, aspect, topographic position, landform, unvegetated surface elements, and descriptive comments (field form and instructions available in Appendix F). Vegetation data included leaf type, physiognomic class, height and canopy cover by vegetative strata, and canopy cover class for the dominant species in each stratum. They also recorded observations on hydrology, fire history,

and whether the vegetation appeared to have changed since the date of the aerial photography. In addition, they described polygon heterogeneity, how much of the polygon was assessed, and their certainty of being in the correct location. One or more digital images were taken at each AA point to provide visual documentation of the site.

Field crews assigned provisional community types using the key to the floristic classification (Appendix J). They assigned types from the floristic classification and not the mapping classification for two reasons: 1) the available key was for the floristic classification, 2) the mapping classification had types at various levels in the USNVC hierarchy and included mapping units that fell between USNVC levels while the floristic classification was populated with types at the lowest level in the classification hierarchy that could be cross-walked to the mapping classification as needed. For example, if a site was keyed in the floristic classification to Sierra lodgepole pine/western Labrador tea forest or Sierra lodgepole pine/gray's licorice-root forest, either of those cross-walk to Sierra lodgepole pine mesic forest superassociation in the mapping classification. The latter falls between levels in the USNVC hierarchy, but it was interpretable from photography.

Following field data collection, the USGS ecologist reviewed the data from each AA point and made a final vegetation type assignment from the floristic classification for comparison with the mapping class assigned during photointerpretation. The relationship between the floristic and mapping classification is represented in a cross-walk table between the two (Appendix P).

#### *Accuracy Assessment Data Analysis*

Once we made final assignments from the floristic classification to each AA point, we then scored each point by comparing the mapping class assigned by the photointerpreters to the mapping class representing the vegetation type assigned by ecologists to the AA point. The scorer determined whether the two assignments were equivalent, and constituted a match for the purposes of meeting accuracy targets.

The scorer compared the ecologist’s assignments with PI assignments and assigned scores based on their equivalency. Situations considered a match based on the crosswalk (Appendix P) were given a score of 5. These included:

- The PI mapping class and AA floristic type are listed in the crosswalk as equivalents
- The PI mapping class is an alliance map unit and the AA type is an association within that alliance.
- The AA type is an alliance and the PI assignment is an association/mapping type that is within that alliance.

Situations not considered a match were given a score less than five. These included:

- PI mapping class and AA type are different associations/mapping types in the same alliance. These were given a score of 4.
- PI mapping class and AA type are in different alliances. These were given a score of 3.

Scores of 1 and 2 were reserved for later modifications to the scoring process.

Reconciling Map Codes and AA Field Data

The scorer attempted to reconcile differences between the AA type and PI assignment. In some cases, the differences were attributable to different estimates of cover by the PI and field crews. If this was the case, the scorer acknowledged the superior ability of the PI to estimate aerial cover from aerial photography. There were four scenarios commonly encountered by the scorer.

1. Total Canopy Cover (Tree vs. Shrub Physiognomy): If crews reported <25% canopy cover (cover classes 1, 2 or 3), the scorer deferred to PI on vegetation physiognomy unless the crew reported a recent disturbance or other factor that could explain the difference. For example, if the crew called the vegetation a huckleberry oak shrubland and noted a low cover of Jeffrey Pine, the scorer deferred to the photointerpreter if the PI code was Jeffrey pine/huckleberry oak woodland because the photointerpreter has a more synoptic view of the polygon for estimating cover and extent of dominants.

2. Cover of Emergents: If a mapping type is defined by emergent conifers over broadleaf tree species, then the PI may have a better estimate of cover (so long as crew notes presence of the correct species). For example, if the crew described a forest as a canyon live oak/whiteleaf manzanita forest and noted a low cover of gray pine, the scorer would defer to the photointerpreter if the PI Code was canyon live oak-gray pine forest.

3. Broadleaf Deciduous vs. Needle-Leaved Evergreen Cover: Some types were defined as a mix of a broadleaf deciduous species and a needle-leaved evergreen species. Given the contrasting difference in photo signatures, we expected the PI to more accurately estimate relative cover of the two groups. As long as the species were correct, the scorer deferred to the PI in these cases where the cover values were inconclusive or marginal. For example, if the primary association in the AA data was ponderosa pine-incense-cedar-black oak and the crew noted a high relative cover of black oak, the scorer deferred to the photointerpreter if PI Code was California black oak-incense-cedar forest.

4. Polygon Boundaries: Crews noted that some polygons are especially narrow and there was ambiguity regarding which vegetation was in the polygon. In some of these cases, there was uncertainty about which of two (or more) types the PI intended to map. As long as the PI code represented one of the types recorded by the field crew, the scorer deferred to the photointerpreter. For example, the polygon is a narrow riparian corridor and the field crew noted that the vegetation in the creek bed was white alder forest grading into white fir-sugar pine-incense-cedar forest on the slopes above. If the PI code was incense-cedar-white alder forest, the scorer deferred to the photointerpreter on the inclusion of conifer cover in the polygon.

In most of these cases, the scorer used the PI code as a source of information about the vegetation in question. Using this information (along with the field crew's data) allowed the scorer to adopt an appropriate assignment to the AA data that may have been different than a type assigned with only field crew data. In many cases, this resulted in a higher score for the polygon, although in some cases it did not affect the score.

## Modified Scoring Rules

In some cases, there were inconsistencies between the mapping classification and floristic classification. In these cases, we modified scoring rules to address these inconsistencies.

### *Types Defined with Low Cover of a Tree Indicator Species*

There are four types that can have very low cover of the indicator tree species. Because there is a lower limit of 5-10% cover for detection of these species by the PI (depending on the overall density of the canopy), we adopted a 10% cutoff value for the indicator species. That is, if there was <10% cover of the indicator species in the AA data that caused the ecologist and PI to differ, the scorer re-keyed the AA data as if the indicator was absent and then compared the result with the PI assignment. Because 10% is the midpoint of a very commonly assigned cover class (5-15%), the scorer applied additional rules in making cover determinations.

1. If the indicator species had 5-15% in one stratum and the species' relative cover indicated it could be <10% absolute cover, the scorer assumed that the species had 10% or less absolute cover. The AA data were re-keyed.

2. If the species had 5-15% in one stratum and the species' relative cover indicated it could be >10%, or the indicator for the PI type was absent, then the scorer assumed that the species had 10% or greater absolute cover. The ecologist's assignment was retained.

3. If the species was assigned 5-15% in 2 strata, the scorer assumed that the total cover was likely greater than 10%. The ecologist's assignment was retained.

4. If the species was assigned <5% in 2 or 3 strata, the scorer assumed that there was <10% absolute cover of the species. The AA data were re-keyed.

5. If the species was assigned 5-15% in 1 stratum, and <5% in another, the scorer looked at the relative cover of the indicator species and the suitability of the PI type to decide the appropriate assignment to the AA data.

There were four types that received this modified scoring due to non-detection of an indicator species by the photointerpreters. The floristic key to alliance and associations (Appendix J) states that stands with the following indicator species >1% or "important in the canopy" belong in the alliance indicated (Table 3). For each of these four types, the scorer applied a 10% minimum cover value of the indicator species to AA data to determine whether there was sufficient cover of the indicator to classify an AA point within the corresponding alliance for comparison with the PI type.

### *Additional Modified Scoring*

Black Oak Alliance. The floristic key indicates that forests and woodlands with >50% relative cover of deciduous species should be assigned to a deciduous forest alliance. The other part of the key step notes that evergreen species are "generally greater than 75% of the relative cover." Mixed evergreen-deciduous forests are defined as having 25-75% total tree cover. These options are not mutually exclusive.

Table 3. Species for which presence or importance in the canopy (minimum cover of 1-2%) resulted in a different classification result for accuracy assessment points compared with the minimum of 5-10% cover required for detection by photointerpreters. Revised scoring was applied to these types when photointerpreters did not detect the indicator species recorded by field crews.

| Indicator Species | Corresponding Alliance in Floristic Key |
|---|---|
| Incense-cedar >1% (when ponderosa pine dominant) | Ponderosa Pine-Incense-cedar Forest Alliance |
| Douglas-fir >1% | Douglas-fir Forest Alliance or Douglas-fir-Ponderosa Pine Alliance |
| Sierra Juniper >2% | Sierra Juniper Woodland Alliance |
| Mountain Hemlock >1% | Mountain Hemlock Forest Alliance |

Preliminary scoring revealed that field crews emphasized the conifer species composition over deciduous cover in the mixed conifer zone, resulting in several stands with a high cover of black oak to be assigned to a ponderosa pine-incense-cedar or Jeffrey pine woodland type. The scorer applied a 50% relative cover cutoff value to assign a stand to the California black oak alliance.

Interior Live Oak Shrubland vs. Woodland. Interior live oak shrubland and interior live oak woodland are in separate alliances. However, these two associations were scored as if they were in the same alliance because they share the same dominant species and habitat and cannot necessarily be distinguished in aerial photography.

Jeffrey Pine-White Fir Woodland. This type is not well differentiated from some other Jeffrey pine types. There is a gradient in both white fir and shrub cover in the plot data that resulted in difficulty scoring stands with greenleaf manzanita, whitethorn ceanothus (*Ceanothus cordulatus*), and/or huckleberry oak present. In scoring former PI code 3086 (Jeffrey pine-white fir woodland and white fir-sugar pine-Jeffrey pine superalliance), if Jeffrey pine and white fir were codominant and shrub (greenleaf manzanita, huckleberry oak, and/or bush chinquapin) total cover was <30% then PI assignment was given a score of 5.

*Mapping Units*

Some of the mapping units do not have equivalents in the floristic key. The scorer used descriptions in the mapping classification (where available) to determine whether AA data matched the vegetation represented by the following mapping units:

- Bigleaf Maple Mapping Unit (formerly PI code 2080[1])
- Mountain Misery-Manzanita sp. Mapping Unit (5131)

[1] Aggregated into PI code 2520, White Alder & Bigleaf Maple Forest Superalliance, following accuracy assessment.

- Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Forest (3047)
- Knobcone Pine-Canyon Live Oak Woodland Mapping Unit (3102)
- Interior Live Oak-California Buckeye Mapping Unit (5041)
- Willow spp. Meadow, Riparian, Talus mapping units (6500, 6600, 6700)

Some of the mapping units that do have floristic equivalents are defined by distinct environmental characteristics rather than strict species composition or have a description of species composition that is more inclusive than the floristic types that are equivalents. The scorer considered the significant role of environmental variables and variation in the expression of these types using the descriptions in the mapping classification as a guide for the following types:

- Quaking Aspen/Willow sp. Talus Mapping Unit (2014)
- Quaking Aspen-Sierra Lodgepole Pine Mapping Units (3010, 3012, and former 3011)
- Former California Red Fir/Mixed Shrub Mapping Unit
- Former White Fir-Sugar Pine/Mixed Shrub Mapping Unit (4090/4095)
- Bitter Cherry Shrubland Alliance (formerly 5220 and then 6300)

Mapping Aggregations and Re-mapping

Preliminary results from the accuracy assessment were delivered to AIS photointerpreters in March of 2006 containing approximately 2100 visits (AA points) encompassing all regions and most types within the park and its surrounding environs. Results were categorized into the following categories:

5 = Correct at the Association Level

4 = Correct at the Alliance Level

3 = Incorrect at the Alliance Level

Photointerpreters evaluated the level 3 and level 4 errors and sent comments about points they questioned back to the USGS ecologist for subsequent review. These were then reviewed again by the USGS ecologist upon which a final ‘score’ was assigned and subsequently sent back for final review by the photointerpreters. AIS then reviewed the remaining types which did not pass and suggested a list of aggregations and re-mapping efforts to be performed prior to the final delivery. This list was reviewed by USGS, DFG, and CNPS ecologists, suggestions were made, and the group agreed upon a final list of aggregations. AIS then reran the AA calculations based on these aggregations, and all but a few types passed. The remaining types not reaching a sufficient level of accuracy were combined through one more aggregation process.

In addition, AIS undertook a remapping effort that entailed reviewing three types using the 1997 aerial photography, National Agriculture Imagery Program (NAIP, U.S. Department of

Agriculture, Farm Service Agency) one meter digital natural color imagery from 2005, and digital orthophoto quarter quadrangles. The remapping of these types was informed by information from the AA points to refine the PI signature. It should be noted that these three types have not undergone subsequent accuracy assessment analysis. The following is a list of the three vegetation types that underwent a remapping effort:

- Type 3085 – Jeffrey Pine-California Red Fir Woodland (*Pinus jeffreyi-Abies magnifica* Woodland)

- Type 1520 – Blue Oak-(Interior Live Oak-Gray Pine/Buckbrush/Annual Grass) Woodland Mapping Unit (*Quercus douglasii*-(*Quercus wislizeni* var. *wislizeni-Pinus sabiniana*/*Ceanothus cuneatus*/Annual Grass) Woodland Mapping Unit)

- Type 4069 – California Red Fir-(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation (*Abies magnifica*-(*Pinus monticola*)/(*Chrysolepis sempervirens-Quercus vaccinifolia-Arctostaphylos nevadensis*) Forest Superassociation)

# Results

## Gradsect Approach to Sampling

Interesting relationships were revealed when we examined the 256 plots collected in 1998 using the gradsect analysis to distribute the field sampling effort. Approximately 150 alliances or associations were sampled in the 145 unique types of BPUs that were visited. Three vegetation types had each received four samples; the remainder had received three or fewer. As many as 24 new, undocumented vegetation types were discovered. When compared with a sample allocation for the jointly mapped Golden Gate National Recreation Area (GGNRA) and Point Reyes National Seashore (PORE) (Schirokauer et al. 2003), which had been driven by photointerpretation, the biophysical analysis at Yosemite had greater efficiency at distributing samples among vegetation types. The use of photointerpretation attributes to select samples at GGNRA–PORE resulted in 23 out of 134 samples being extraneous due to incorrect photointerpretation identifications. By contrast, the BPU analysis at YOSE yielded near 100 percent efficiency, that is, every sample collected was needed for mapping and/or analysis. This was a result of increased efficiency in the identification of unique environmental settings as well as a more efficient tracking of "minimum samples required" implemented by the Yosemite field crews.

Previous sampling within Yosemite and environs had not been quite as efficient. Including the 1998 samples, 1,608 ecological plots had been collected within the environs since the 1930s. Comparing the locations of all plots against the BPUs, only 622 BPU types had been sampled at least once. This left 775 BPU types to be examined. Time and funding constraints prohibited a field visit to each of these types. However, combining photointerpretation with biophysical and cost surface analyses could effectively focus sampling on the types needed for mapping and classification.

In the 1999 field season, the emphasis was on obtaining adequate samples for as many vegetation types as time allowed. Visiting unsampled BPUs was deemphasized because the photointerpreters were better able to direct the field crews to underrepresented vegetation types. It is still interesting to note the results of 1998 and 1999 field sampling in terms of BPUs visited. Two hundred seventy-two BPU types were visited in the 1998 and 1999 field seasons. Adding all other previously collected data sets (Wieslander, NRI, etc.) brought the total of sampled BPUs to 816 of 1,397. However, looking at the acreage of the mapping area corresponding with the sampled BPU types, roughly 85 percent of the park's surface area has been sampled. Of the 15 percent unsampled, the vast majority is composed of steep slopes (unsafe for sampling), high elevation sites (probably snow fields or barren), roads, streams, and lakes. The unsampled BPUs, therefore, only correspond with about 1.5 percent of the mapping area's total surface area.

## Vegetation Classification and Key

The final vegetation classification for Yosemite National Park and environs consists of 114 alliances and 209 associations. Not all alliances have defined associations but many have several associations each. At the association level, there are 106 forests and woodlands, 43 shrublands, seven dwarf-shrublands, and 53 herbaceous vegetation types. The classification results reflect both the high diversity of vegetation in the park and vicinity and the previous lack of comprehensive vegetation classification work in the region.

The associations in the final classification are listed hierarchically in Appendix I, and a key to the associations is provided in Appendix J. Complete descriptions for each association are found in Appendix K. Each description is titled with the association name and includes an author if the association had been defined prior to this project. We were conservative about association names and retained original authors' names even if the type name does not follow alliance name order. Each also includes a sample size based on the number of samples collected or analyzed for this report and used to develop the description. We tested and refined the key during the accuracy assessment phase in 2002-2003. We also made minor refinements following a workshop on the mapping effort offered through the Jepson Herbarium.

We defined approximately 114 new associations using data collected and analyzed during the course of this project. These are indicated with an asterisk following the name in the classification list (Appendix I), and they are listed separately in Appendix L. Of these types, 56 were represented with fewer than 10 plots and are therefore considered provisional and will require further field data. Those requiring further sampling are indicated with a plus sign (+) following the name of the association. A further 36 preliminary units were sampled with fewer than three plots and may suggest other possible associations that require further sampling before they can be validated. These are also indicated in the classification list, and they are listed separately in Appendix M.

There were approximately 87 associations previously defined by other authors that occur in Yosemite or the environs according to plot data. Of these, there were 33 forest associations (evergreen and deciduous), 15 woodlands, 8 shrublands, and 31 herbaceous associations previously defined. Potter (1998) made the largest contribution to the understanding of upper montane forest vegetation and Taylor (1984) did so among the alpine communities.

### The Vegetation within Yosemite National Park

Within the park, photointerpreters mapped 56% as forest, 18% as woodland, 7% as shrubland, and 3% as herbaceous (Table 4). Evergreen forests, including both needle-leaved and broad-leaved evergreen forests, dominate at nearly 55% of the park. Within mapped evergreen forest, 94% is needle-leaved evergreen forest and only 6% is broad-leaved evergreen forest. The latter consists entirely of canyon live oak types. Evergreen and deciduous shrublands are in nearly equivalent proportions, with deciduous shrublands consisting largely of shrub willow types. Evergreen shrublands largely consist of montane chaparral types (88%) such as greenleaf manzanita (*Arctostaphylos patula*), huckleberry oak (*Quercus vaccinifolia*), and whitethorn ceanothus. The remainder is microphyllous evergreen shrubland (12%) including mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), oceanspray (*Holodiscus discolor* var. *microphyllus*), and red mountainheather (*Phyllodoce breweri*). It should be noted that the classification is in the pre-2008 USNVC hierarchy. The revised hierarchy is available through the USNVC Hierarchy Explorer (http://usnvc.org/explore-classification/).

Annual herbaceous vegetation is much less abundant in the park than perennial herbaceous vegetation due to the low representation of foothill habitats. Annual grasslands and herblands comprise just 0.8% of the upland herbaceous. Of the 9,903 ha of herbaceous vegetation, 63% is mapped as wetland and 37% is mapped as upland. Upland herbaceous types are comprised of the high elevation shorthair sedge alliance (69% of upland herbaceous mapped), a mesic post fire herbaceous mapping unit (21%), and a generic upland graminoid signature (9%). Wetland

herbaceous is largely divided into intermittently to seasonally flooded meadow (89% of wetland herbaceous) and semi-permanently to permanently flooded meadow (10%).

Table 4. Abundance of mapped vegetation within Yosemite National Park by NatureServe (2007) Formation Class and Formation Subclass. Evergreen Forest and Evergreen Woodland include needle-leaved and broad-leaved evergreen types.

| Formation (Subclass / Class) | Area (ha) | Area (acres) | Percent |
|---|---|---|---|
| Evergreen Forest | 173,544 | 428,827 | 54.7 |
| Deciduous Forest | 3,633 | 8,976 | 1.1 |
| **Forest** | **177,177** | **437,803** | **55.9** |
| Evergreen Woodland | 56,570 | 139,785 | 17.8 |
| Deciduous Woodland | 85 | 211 | 0.03 |
| **Woodland** | **56,656** | **139,996** | **17.9** |
| Evergreen Shrubland | 11,473 | 28,350 | 3.6 |
| Deciduous Shrubland | 9,713 | 24,002 | 3.1 |
| Evergreen Dwarf-shrubland | 107 | 265 | 0.03 |
| **Shrubland** | **21,294** | **52,617** | **6.7** |
| Perennial Graminoid Vegetation | 9,092 | 22,466 | 2.9 |
| Perennial Forb Vegetation | 764 | 1,889 | 0.2 |
| Annual graminoid or forb vegetation | 30 | 73 | 0.01 |
| Hydromorphic Rooted Vegetation | 17 | 42 | 0.01 |
| **Herbaceous** | **9,903** | **24,470** | **3.1** |
| **Sparse Vegetation** | **46,948** | **116,009** | **14.8** |
| **Other (Snow, Water, Developed)** | **5,055** | **12,490** | **1.6** |
| **Total** | **317,032** | **783,385** | **100.0** |

The final map has 107 different mapping classes (in the PIFinal field), at various levels in the classification hierarchy, within Yosemite National Park (Appendix H). These classes, including alliances, associations, and other mapping units, are mapped among 45,540 different stands (polygons), including sparsely vegetated types. There are 45 forest classes, 22 woodland classes, 16 shrubland classes, 1 dwarf-shrubland class, and 8 herbaceous classes mapped within the park. There are 12 sparsely vegetated types, including alpine talus slope, alpine scree slope, boulder field, and dome. There are 3 unvegetated types: water, permanent snowfield/glacier, and urban/developed.

At the level of vegetation alliance and above, there are 32 different alliances mapped within the park plus 6 superalliances (mapping units representing more than one alliance, e.g., white alder & bigleaf maple forest superalliance), and 14 mapping units (Table 5). Some of the latter are physiognomic-floristic units that are not species specific (e.g., willow spp. forest mapping unit) or physiognomic units in select habitat conditions that are not species specific (e.g., mesic post fire herbaceous mapping unit).

The number of mapping classes within forest and woodland alliances vary from one (e.g., western white pine woodland alliance with one association) to 10 (e.g., Sierra lodgepole pine forest alliance). Shrubland alliances are mostly represented by single mapping units (e.g., deerbrush shrubland alliance and chamise shrubland association), but there are three superalliances comprised of three to four shrubland alliances that could not, ultimately, be successfully distinguished in the aerial photography. For example, there is a greenleaf manzanita & bush chinquapin & huckleberry oak shrubland superalliance.

Sierra lodgepole pine forest alliance occupies the greatest area of any mapped alliance (10% of the park) followed by Jeffrey pine woodland alliance, California red fir forest alliance, and western white pine-(California red fir-Sierra lodgepole pine) forest superassociation (Table 5). The latter three occupy nearly equal area between 24,000 and 25,000 ha each (7.7 to 7.9% of the park). Montane white fir-sugar pine forest alliance and subalpine whitebark pine woodland alliance occupy nearly equal area between 18,000 and 19,000 ha each (6.0 and 5.7% of the park, respectively). Among the alliances occupying the least area in the park are chamise shrubland alliance, a very common low elevation chaparral in California with little representation in the park, and black cottonwood temporarily flooded forest alliance, a species largely limited to narrow riparian and meadow-edge areas at low elevations within the mapping area.

Among sparsely vegetated areas, rock has the greatest proportion at nearly 15%, reflecting the park's glacial history. Features mapped as sparsely vegetated rock include domes, alpine and non-alpine talus, alpine scree slopes, boulder fields, and mesic rock outcrops. Water makes up the next largest sparsely vegetated/unvegetated area. Permanent snowfields and glaciers comprise only 0.1% of the park.

No fire severity modifiers were assigned for most of the park (94% of the park has a fire severity code of 9, no modifier), indicating photointerpreters saw little evidence of fire effects (>90% of original vegetation remaining). Within 6% of the park, photointerpreters assigned 3,930; 2,465; and 11,977 ha to high, moderate, and low fire severity, respectively (Table 6). By far the largest area with evidence of fire effects was west and southwest of Hetch Hetchy Reservoir within the 1996 Ackerson Fire (Figure 2) which occurred the year prior to when the source imagery for the map was obtained. Outside of the park, the same 1996 burn had the largest area with fire effects. The fire perimeter describes an area 23,938 ha (59,153 acres) total, with 18,983 ha (79%) inside the park. Other fires within the five year fire history prior to 1997 that exhibited fire effects in the aerial photography were the Horizon Fire (1994) at 1,745 ha (4,312 acres) and a 1992 fire in the Middle Fork of the San Joaquin River for which we do not have data on total area.

The most common mapping units within high fire severity in the park were 6900, mesic montane shrubland (3063 ha), and 7702, mesic post fire herbaceous (580 ha). The most common mapping units within low severity burns in the park were 4070, California red fir–white fir forest (2176 ha), 4530, white fir-sugar pine-(incense-cedar-Jeffrey pine) forest (1813 ha), and 3066, ponderosa pine-incense-cedar-(California black oak-canyon live oak) forest (1410 ha). However, these are reflections of only the most immediate fire effects discernable within the aerial photography (approximately the previous five year fire history) not long-term effects of fire extent and severity.

Table 5. Abundance by mapping unit at the alliance or higher level of classification within Yosemite National Park. Alliances and mapping units are grouped by NatureServe (2007) Formation Class (Forest, Woodland, etc.) and by Formation Subclass (Evergreen Forest, Deciduous Forest, etc.).

| PI Code | Common Name | Scientific Name | Area (ha) | Area (acres) | Percent of Park |
|---|---|---|---|---|---|
| ***Forest - Evergreen Forest*** | | | | | |
| 1020 | Canyon Live Oak Forest Alliance | *Quercus chrysolepis* Forest Alliance | 9,630 | 23,797 | 3.0 |
| 1510 | Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit | *Quercus chrysolepis*/*Aesculus californica* Woodland & *Quercus wislizeni-Aesculus californica* Shrubland Mapping Unit | 30 | 73 | 0.01 |
| 3020 | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta* var. *murrayana* Forest Alliance | 32,400 | 80,060 | 10.2 |
| 3060 | Ponderosa Pine-Incense-cedar Forest Alliance | *Pinus ponderosa-Calocedrus decurrens* Forest Alliance | 15,907 | 39,306 | 5.0 |
| 4010 | Douglas-fir Forest Alliance | *Pseudotsuga menziesii* Forest Alliance | 866 | 2,139 | 0.3 |
| 4020 | Giant Sequoia Forest Alliance | *Sequoiadendron giganteum* Forest Alliance | 134 | 331 | 0.04 |
| 4030 | Mountain Hemlock Forest Alliance | *Tsuga mertensiana* Forest Alliance | 16,880 | 41,711 | 5.3 |
| 4050 | California Red Fir Forest Alliance | *Abies magnifica* Forest Alliance | 24,322 | 60,100 | 7.7 |
| 4070 | California Red Fir-White Fir Forest Alliance | *Abies magnifica-Abies concolor* Forest Alliance | 20,918 | 51,688 | 6.6 |
| 4080 | White Fir-Sugar Pine Forest Alliance | *Abies concolor-Pinus lambertiana* Forest Alliance | 18,958 | 46,845 | 6.0 |
| 4110 | Incense-cedar Forest Alliance | *Calocedrus decurrens* Forest Alliance | 64 | 158 | 0.02 |
| 4510 | Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance | *Pinus monticola*-(*Abies magnifica-Pinus contorta* var. *murrayana*) Forest Superalliance | 24,263 | 59,953 | 7.7 |
| 4520 | White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/(Pinemat Manzanita-Whitethorn Ceanothus) Forest Mapping Unit | *Abies concolor*-(*Abies magnifica-Pinus lambertiana-Pinus jeffreyi*)/(*Arctostaphylos nevadensis-Ceanothus cordulatus*) Forest Mapping Unit | 3,057 | 7,554 | 1.0 |
| 4550 | Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit | *Pseudotsuga menziesii*-(*Abies concolor-Calocedrus decurrens-Pinus ponderosa*) Forest Mapping Unit | 1,851 | 4,574 | 0.6 |
| 910/20 | Conifer Reproduction/Plantation | Conifer Reproduction/Plantation | 2,370 | 5,856 | 0.7 |

| PI Code | Common Name | Scientific Name | Area (ha) | Area (acres) | Percent of Park |
|---|---|---|---|---|---|
| ***Forest - Deciduous Forest*** | | | | | |
| 2010 | Quaking Aspen Forest Alliance | *Populus tremuloides* Forest Alliance | 1,114 | 2,752 | 0.4 |
| 2020 | California Black Oak Forest Alliance | *Quercus kelloggii* Forest Alliance | 2,377 | 5,874 | 0.7 |
| 2050 | Black Cottonwood Temporarily Flooded Forest Alliance | *Populus balsamifera* ssp. *trichocarpa* Temporarily Flooded Forest Alliance | 38 | 93 | 0.01 |
| 2510 | Willow spp. Forest Mapping Unit | *Salix* spp. Forest Mapping Unit | 1 | 2 | <0.01 |
| 2520 | White Alder & Bigleaf Maple Forest Superalliance | *Alnus rhombifolia* & *Acer macrophyllum* Forest Superalliance | 103 | 255 | 0.03 |
| ***Woodland - Evergreen Woodland*** | | | | | |
| 1040 | Interior Live Oak Woodland Alliance | *Quercus wislizeni* var. *wislizeni* Woodland Alliance | 250 | 618 | 0.1 |
| 3050 | Ponderosa Pine Woodland Alliance | *Pinus ponderosa* Woodland Alliance | 1,923 | 4,753 | 0.6 |
| 3070 | Jeffrey Pine Woodland Alliance | *Pinus jeffreyi* Woodland Alliance | 24,947 | 61,645 | 7.9 |
| 3090 | Gray Pine Woodland Alliance | *Pinus sabiniana* Woodland Alliance | 611 | 1,510 | 0.2 |
| 3110 | Singleleaf Pinyon Pine Woodland Alliance | *Pinus monophylla* Woodland Alliance | 31 | 76 | 0.01 |
| 3130 | Western White Pine Woodland Alliance | *Pinus monticola* Woodland Alliance | 3,388 | 8,372 | 1.1 |
| 3140 | Whitebark Pine Woodland Alliance | *Pinus albicaulis* Woodland Alliance | 18,089 | 44,698 | 5.7 |
| 4100 | Sierra Juniper Woodland Alliance | *Juniperus occidentalis* var. *australis* Woodland Alliance | 9,225 | 22,794 | 2.9 |
| ***Woodland - Deciduous Woodland*** | | | | | |
| 2030 | Blue Oak Woodland Alliance | *Quercus douglasii* Woodland Alliance | 69 | 170 | 0.02 |
| 2040 | Valley Oak Woodland Alliance | *Quercus lobata* Woodland Alliance | 17 | 41 | 0.01 |
| ***Shrubland - Evergreen Shrubland*** | | | | | |
| 5020 | Chamise Shrubland Alliance | *Adenostoma fasciculatum* Shrubland Alliance | 3 | 7 | <0.01 |
| 5040 | Interior Live Oak Shrubland Alliance | *Quercus wislizeni* var. *frutescens* Shrubland Alliance | 16 | 38 | <0.01 |
| 5060 | Chaparral Whitethorn Shrubland Alliance | *Ceanothus leucodermis* Shrubland Alliance | 22 | 55 | 0.01 |
| 5110 | Whitethorn Ceanothus Shrubland Alliance | *Ceanothus cordulatus* Shrubland Alliance | 1,846 | 4,561 | 0.6 |
| 5130 | Mountain Misery Dwarf-shrubland Alliance | *Chamaebatia foliolosa* Dwarf-shrubland Alliance | 107 | 265 | 0.03 |

| PI Code | Common Name | Scientific Name | Area (ha) | Area (acres) | Percent of Park |
|---|---|---|---|---|---|
| 5510 | Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance | *Artemisia tridentata* ssp. *vaseyana* & *Artemisia rothrockii* & *Holodiscus discolor* & *Phyllodoce breweri* Shrubland Superalliance | 1,326 | 3,276 | 0.4 |
| 5560 | Chamise-(Buckbrush-Whiteleaf Manzanita) Shrubland Mapping Unit | *Adenostoma fasciculatum*-(*Ceanothus cuneatus*-*Arctostaphylos viscida*) Shrubland Mapping Unit | 3 | 8 | <0.01 |
| 5570 | Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Superalliance | *Arctostaphylos patula* & *Chrysolepis sempervirens* & *Quercus vaccinifolia*Shrubland Superalliance | 8,077 | 19,959 | 2.5 |
| 5580 | Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance | *Cercocarpus betuloides* & *Ceanothus cuneatus* & *Arctostaphylos viscida* Shrubland Superalliance | 174 | 431 | 0.1 |
| | Silver Lupine Shrubland Alliance | *Lupinus albifrons* Shrubland Alliance | 6 | 14 | 0.00 |
| ***Shrubland - Deciduous Shrubland*** | | | | | |
| 6010 | Deerbrush Shrubland Alliance | *Ceanothus integerrimus* Shrubland Alliance | 1,012 | 2,500 | 0.3 |
| 6110 | Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance | *Salix orestera*/*Allium validum* Seasonally Flooded Shrubland Alliance | 2,343 | 5,790 | 0.7 |
| 6500 | Willow spp./Meadow Shrubland Mapping Unit | *Salix* spp./Meadow Shrubland Mapping Unit | 403 | 995 | 0.1 |
| 6600 | Willow spp. Riparian Shrubland Mapping Unit | *Salix* spp. Riparian Shrubland Mapping Unit | 633 | 1,563 | 0.2 |
| 6700 | Willow spp. Talus Shrubland Mapping Unit | *Salix* spp. Talus Shrubland Mapping Unit | 1,690 | 4,176 | 0.5 |
| 6900 | Mesic Montane Shrubland Mapping Unit | Mesic Montane Shrubland Mapping Unit | 3,633 | 8,977 | 1.1 |
| ***Herbaceous Vegetation - Annual*** | | | | | |
| 7260 | California Annual Grassland/Herbland Superalliance | California Annual Grassland/Herbland Superalliance | 30 | 73 | 0.01 |
| ***Herbaceous Vegetation - Perennial*** | | | | | |
| 7120 | Shorthair Sedge Herbaceous Alliance | *Carex exserta* Herbaceous Alliance | 2,543 | 6,284 | 0.8 |
| 7550 | Upland Graminoids | Upland Graminoids | 343 | 848 | 0.1 |
| 7701 | Post-clearcut Shrub/Herbaceous Mapping Unit | Post-clearcut Shrub/Herbaceous Mapping Unit | 3 | 9 | <0.01 |

| PI Code | Common Name | Scientific Name | Area (ha) | Area (acres) | Percent of Park |
|---|---|---|---|---|---|
| 7702 | Mesic Post Fire Herbaceous Mapping Unit | Mesic Post Fire Herbaceous Mapping Unit | 764 | 1,889 | 0.2 |
| 8000 | Intermittently to Seasonally Flooded Meadow | Intermittently to Seasonally Flooded Meadow | 5,554 | 13,725 | 1.8 |
| 9000 | Semi-permanently to Permanently Flooded Meadow | Semi-permanently to Permanently Flooded Meadow | 648 | 1,601 | 0.2 |
| ***Sparse Vegetation/Unvegetated*** | | | | | |
| | Sparsely Vegetated Rock | | 46,948 | 116,011 | 14.8 |
| | Hydromorphic-rooted Vegetation | | 17 | 42 | <0.01 |
| | Permanent Snowfield/Glacier | | 342 | 845 | 0.1 |
| | Water | | 4,607 | 11,384 | 1.5 |
| | Urban/Developed | | 106 | 262 | <0.01 |
| **Total** | | | **317,032** | **783,387** | **100.0** |

Table 6. A total of 6% of Yosemite National Park was within the five year fire history prior to 1997 and showed evidence of high (0 to 10% of the original vegetation remaining), moderate (10 to 50% of original vegetation remaining), or low (50 to 90% of the original vegetation remaining) fire severity.

| Fire Severity Code | Fire Severity Descriptor | Area (ha) | Area (acres) | Percent of Park |
|---|---|---|---|---|
| 1 | High | 3,930 | 9,710 | 1.3 |
| 2 | Moderate | 2,465 | 6,091 | 0.8 |
| 3 | Low | 11,977 | 29,594 | 4.0 |
| **Total** | | **18,371** | **45,396** | **6.1** |

## The Vegetation across the Entire Mapping Area

Across the entire mapping area, the photointerpreters mapped 51.5% as forest, 17.7% as woodland, 10.6% as shrubland, and 3.1% as herbaceous (Table 7). The remaining 17.1% was sparsely vegetated areas and non-vegetated snow, water, and developed areas. Tree-dominated vegetation in general (forest and woodland) totaled 388,537 ha (960,096 acres) or 69% of the mapping area. The shrubland proportion increased for the entire mapping area compared with the park with the addition of the more xeric eastern slope and lower foothill areas on the western slope.

There are an additional 23 classes mapped within the environs that do not occur within Yosemite National Park, bringing the total number of types mapped within the environs, the park, and the monument, together, to 130. These are mapped among 84,955 polygons, including sparsely vegetated types.

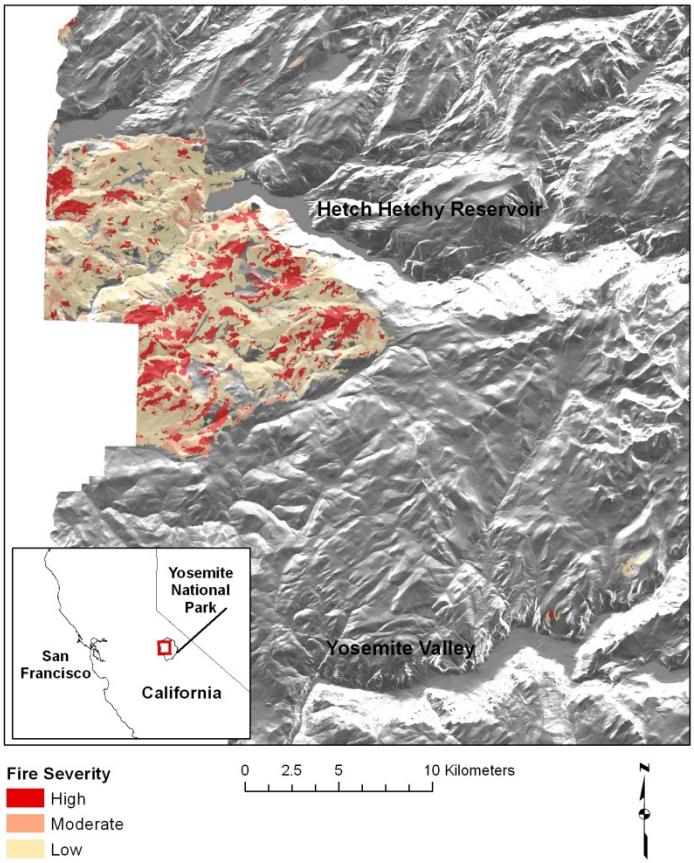


Figure 2. Fire severity within Yosemite National Park interpreted from August 1997 aerial photography as high (0 to 10% of the original vegetation remaining), moderate (11 to 50% remaining), or low (51 to 90% remaining). Photointerpreters noted no fire severity evidence for 94% of the park.

## The Vegetation within Devils Postpile National Monument

Photointerpreters mapped 21 different types within DEPO in 84 different stands (polygons), not counting exposed rock and water. Approximately 1.8% of the monument was mapped as broad- leaved

Table 7. Abundance by NatureServe (2007) Formation Class and Formation Subclass within the entire mapping area. Evergreen Forest and Evergreen Woodland include needle-leaved and broad-leaved evergreen types.

| Formation (Subclass / Class) | Area (ha) | Area (acres) | Percent |
|---|---|---|---|
| Evergreen Forest | 276,402 | 683,005 | 49.2 |
| Deciduous Forest | 12,673 | 31,316 | 2.3 |
| **Forest** | **289,075** | **714,321** | **51.5** |
| Evergreen Woodland | 99,213 | 245,160 | 17.7 |
| Deciduous Woodland | 249 | 616 | 0.04 |
| **Woodland** | **99,462** | **245,775** | **17.7** |
| Evergreen Shrubland | 40,942 | 101,170 | 7.3 |
| Deciduous Shrubland | 16,903 | 41,768 | 3.0 |
| Evergreen Dwarf-shrubland | 1,870 | 4,622 | 0.3 |
| **Shrubland** | **59,715** | **147,560** | **10.6** |
| Perennial Graminoid Vegetation | 16,254 | 40,164 | 2.9 |
| Perennial Forb Vegetation | 958 | 2,367 | 0.2 |
| Annual graminoid or forb vegetation | 199 | 491 | <0.1 |
| Hydromorphic Rooted Vegetation | 33 | 82 | <0.1 |
| **Herbaceous** | **17,443** | **43,103** | **3.1** |
| **Sparse Vegetation** | **86,434** | **213,584** | **15.4** |
| **Other (Snow, Water, Developed)** | **9,584** | **23,682** | **1.7** |
| **Total** | **561,714** | **1,388,024** | **100.0** |

deciduous forest, 69.3% as needle-leaved evergreen forest, 17.7% as deciduous shrubland, 1.6% as evergreen shrubland, and 2.2% as herbaceous. The latter included a seasonally flooded meadow (5.2 ha [12.8 ac]) as well as a mapping unit used to capture recently burned areas dominated by herbaceous vegetation in mesic settings (i.e., 7702, mesic post fire herbaceous mapping unit)(1.8 ha [4.5 ac]). Nearly 5% was mapped as exposed rock and 2.7% as water.

California red fir-white fir forest alliance was the most commonly mapped type within DEPO at 44% followed by mesic montane shrubland mapping unit at 16% (Table 8). California red fir forest alliance and Sierra lodgepole pine woodland alliance were the next most common at 11% and 9%, respectively. All other types mapped each comprised less than 5% of DEPO.

## Accuracy Assessment Results

Of 2,175 accuracy assessment (AA) points, 1,123 (53%) fell within Yosemite National Park, 3 within Devils Postpile National Monument, and 988 (47%) within the environs outside the park and monument (Figure 3). Although only three AA points fell within the boundary of DEPO, approximately 82 fell within the headwaters of the Middle Fork of the San Joaquin River and an additional 61 were located within the upper San Joaquin watershed. As a result, data from 143 AA points within the vicinity of DEPO contributed to assessing map accuracy.

Table 8. Area and proportion of vegetation types mapped within Devils Postpile National Monument at the alliance level or higher based on August 1997 aerial photography. Alliances and mapping units are grouped by NatureServe (2007) Formation Class (Forest, Woodland, etc.) and by Formation Subclass (Evergreen Forest, Deciduous Forest, etc.).

| PI Code | Vegetation Alliance or Comparable Type | Area (ha) | Area (acres) | Percent |
|---|---|---|---|---|
| ***Forest - Evergreen Forest*** | | | | |
| 3020 | Sierra Lodgepole Pine Forest Alliance | 28.5 | 70.4 | 8.8 |
| 4030 | Mountain Hemlock Forest Alliance | 2.5 | 6.1 | 0.8 |
| 4050 | California Red Fir Forest Alliance | 37.0 | 91.3 | 11.4 |
| 4070 | California Red Fir-White Fir Forest Alliance | 143.2 | 353.8 | 44.3 |
| 4510 | Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance | 0.2 | 0.4 | 0.1 |
| ***Forest - Deciduous Forest*** | | | | |
| 2010 | Quaking Aspen Forest Alliance | 3.6 | 9.0 | 1.1 |
| 2050 | Black Cottonwood Temporarily Flooded Forest Alliance | 2.2 | 5.5 | 0.7 |
| 3070 | Jeffrey Pine Woodland Alliance | 7.8 | 19.4 | 2.4 |
| 4100 | Sierra Juniper Woodland Alliance | 4.9 | 12.1 | 1.5 |
| ***Shrubland - Evergreen Shrubland*** | | | | |
| 5110 | Whitethorn Ceanothus Shrubland Alliance | 5.2 | 12.9 | 1.6 |
| ***Shrubland - Deciduous Shrubland*** | | | | |
| 2070 | Mountain Alder Shrubland Alliance | 3.5 | 8.7 | 1.1 |
| 6600 | Willow spp. Riparian Shrubland Mapping Unit | 2.4 | 5.8 | 0.7 |
| 6900 | Mesic Montane Shrubland Mapping Unit | 51.5 | 127.3 | 15.9 |
| ***Herbaceous Vegetation*** | | | | |
| 7702 | Mesic Post Fire Herbaceous Mapping Unit | 1.8 | 4.5 | 0.6 |
| 8000 | Intermittently to Seasonally Flooded Meadow | 5.2 | 12.8 | 1.6 |
| ***Sparse Vegetation*** | | | | |
| 500 | Sparsely Vegetated Rock | 15.2 | 37.6 | 4.7 |
| 980 | Water | 8.7 | 21.5 | 2.7 |
| **Total** | | **323.5** | **799.1** | **100** |

### *Post Accuracy Assessment Modifications to the Mapping Classification*

In the final map attributes, three fields exist as a result of the aggregations and modifications performed on the classification subsequent to the accuracy assessment analysis. The three fields, each of which refer to the vegetation mapping class codes, enable the user to track back to the original photointerpretation and the original mapped code on the photo overlay. This allows the users of the map to review and assess original codes that did not pass the accuracy assessment analysis. Tracking back to the original photointerpretation codes that were assigned prior to the final aggregated code being established may provide a useful tool to the user. The three fields are described below:

PIORIGINAL: This is the original photointerpretation code directly transferred from the hard copy aerial photo overlays of 1997 photography (1:15,860) that were delineated by the

photointerpreter. The code was directly input into the digital database and no changes or updates have been performed on this field. Data in the PIORIGINAL field were retained only to keep the original linework. Many codes are out of date. Users should not use the codes from this field.

PIPREFINAL: Two types of information are stored in the PIPREFINAL field: 1) vegetation classes that were close to passing the accuracy standard but did not meet the required 80% and so were aggregated into other types in the PIFINAL field and 2) classes that did not have accuracy assessed, including alpine types, shrub willow types, upland herbaceous types, and meadow types. In both cases, the original, detailed information is retained in this field to make it available to users; however, users should access this information at their own discretion. The only classes included in the former are 1) 2012 and 2017 which were aggregated into 2010 and 2) 3011 which was aggregated into 3010 (see Appendix H for names associated with vegetation type codes). The latter case, where greater detail is available in the PIPREFINAL field but without assessed accuracy, includes 1) alpine slopes, 2) shrub willow types, 3) upland herbaceous, and 4) meadows. Again, information available in the PIPREFINAL field should only be used with discretion because accuracy was not assessed.

For example, alpine slopes are represented as either 100 (alpine talus slope) or 200 (alpine scree slope) in PIFINAL. They were originally mapped according to substrate grain size (talus or scree), slope shape (concave or convex), and aspect (northerly facing or southerly). The detail retained in the PIPREFINAL field is shown in the gray text of the mapping classification list in Appendix H.

Similarly, the PIPREFINAL field contains more detail for willow shrublands than the PIFINAL field. Where codes in the PIFinal field separate willow shrublands into riparian settings, meadow settings, and talus settings, the PIPREFINAL field provides the detail with which they were originally mapped by designating the ecological zones in which they occurred. The listed ecological zones provide the context for the shrub willow stands mapped (see the additional detail indicated in the gray text for 6502 through 6515 in Appendix H. The PIPreFinal field also contains more detail for upland continuous forming graminoids. Where the PIFinal field contains 7550, the additional detail available in the PIPreFinal field for interested users includes polygon assignments where there were particular photographic signatures or the apparent presence of a tall forb layer. See codes 7500, 7501, 7510, 7511, 7512, 7530, 7540 and 7541 in gray in Appendix H.

PIFINAL: This field is the result of three final sets of changes to the database:

- Final Aggregations to meet accuracy assessment standards
- Re-mapping efforts that were performed on several floristic types (see Accuracy Assessment Data Analysis section above)
- Numeric updates to mapping class assignments which conform to the National Vegetation Classification Hierarchy (for example – changing a numeric value for all polygons labeled 4074 to 4070).

Aggregations from the original mapped types to final mapping classes to meet desired accuracy levels can be found by comparing codes in the PIOriginal field in the attributes of the final map. For example, entries of the map code 3061 in the PIOriginal field are map code 3066 in the

PIFinal field, indicating that polygons originally mapped as ponderosa pine-incense-cedar-canyon live oak/mountain misery forest association are now aggregated into ponderosa pine-incense-cedar–(California black oak-canyon live oak) forest superassociation.

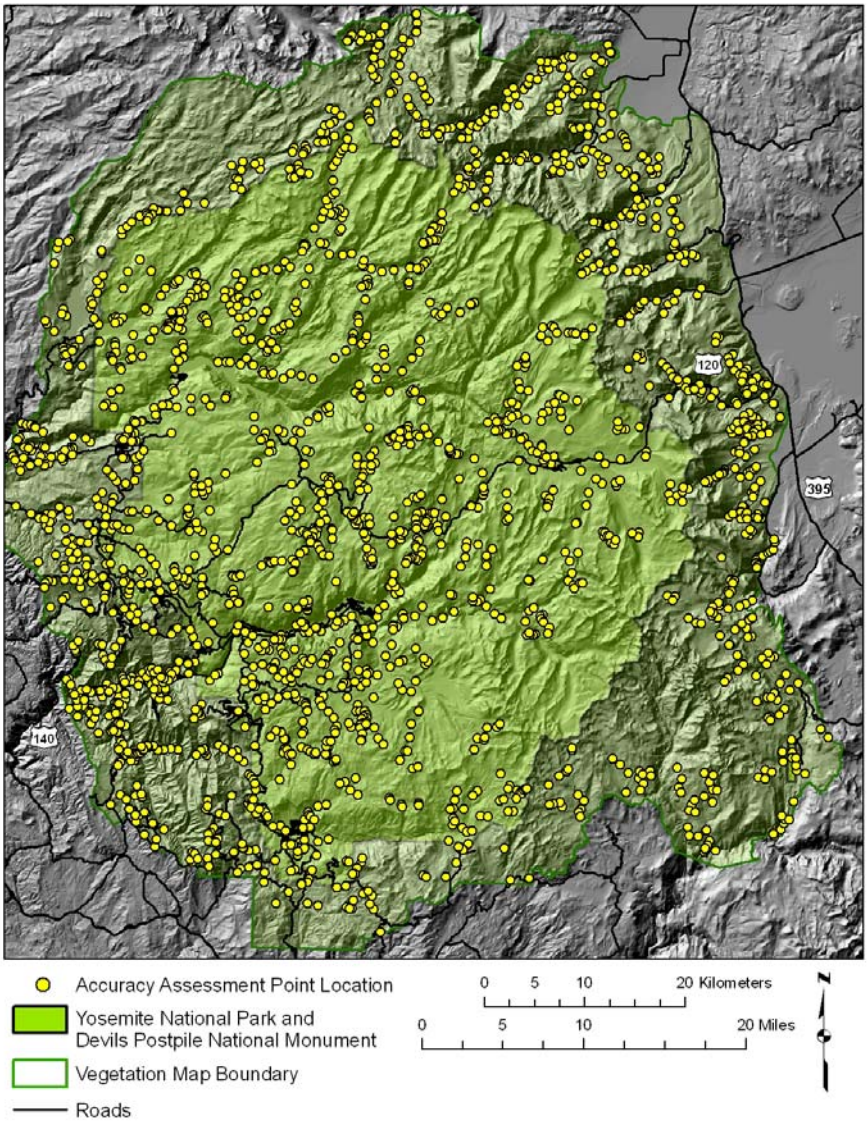


Figure 3. Data from nearly 2,200 accuracy assessment points were collected to estimate vegetation map accuracy for Yosemite National Park and vicinity.

Following aggregation of types to meet minimum levels of accuracy, the number of AA points among mapping types varied from 1 to 92. One type had 92 valid assessment points because it was aggregated from six associations and mapping units that were individually assessed but that could not, ultimately, be distinguished. These were units with combinations of mountain hemlock, western white pine, Sierra lodgepole pine, and California red fir. The result of the aggregation of these classes is the mountain hemlock-(western white pine-Sierra lodgepole pine) forest superassociation (PIFinal=4035) which has an estimated accuracy of 88%. Four mapping classes each had fewer than four AA points: black cottonwood-quaking aspen-(Jeffrey pine)/willow spp. mapping unit (PIFinal=2052), Jeffrey pine-singleleaf pinyon pine woodland association (PIFinal=3081), Sierra willow/swamp onion seasonally flooded shrubland alliance (PIFinal=6110), and willow spp. forest mapping unit (PIFinal=2510). However, 70 mapping classes had 10 or more AA points each, and 40 types had more than 20 AA points each. The approach of assessing more common classes with more AA points and less common classes with fewer AA points resulted in high numbers of assessments for the most commonly occurring classes. Some sampling intensities were unnecessarily high. White fir-sugar pine-(incense-cedar-Jeffrey pine) mapping unit was assessed with 82 AA points as a result of aggregation (AA points from aggregated types are applied to the new type). A statistically valid accuracy estimate could have been achieved with

fewer assessed polygons. Several classes received no assessments due to their rarity. These included valley oak woodland alliance (5 polygons), limber pine woodland alliance (37 polygons), and chaparral whitethorn shrubland alliance (5 polygons).

### *Thematic Map Accuracy*

A confusion matrix showing map accuracy estimates by association and by alliance is available among the products from this project and available through the NPS Vegetation Inventory Program web site (http://science.nature.nps.gov/im/inventory/veg/index.cfm). The confusion matrix (also known as an error matrix) provides estimates of both producer's and user's accuracy. Producer's accuracy is the number of samples classified correctly divided by the total number of AA points in that class that were visited in the field. It indicates how often real features on the ground are correctly shown in the map and is viewed as map accuracy from the point of view of a map producer. User's accuracy is the number of samples classified correctly divided by the total number of AA points falling in polygons mapped as that class. It indicates how often the type in the map matches the type on the ground and is viewed as map accuracy from the point of view of a map user. Here we report estimated user's accuracies. The confusion matrix is also the best source of information on which types were confused with other types.

Of the 91 final mapping classes for which accuracy was assessed, 62 (68%) have an estimated user's accuracy of 80% or greater (60 types have a producer's accuracy of 80% or greater). Among the highest accuracy estimates for those types with more than 10 AA points were for curl-leaf mountain mahogany woodland alliance (PIFinal=5230, 94% based on 37 points), Sierra juniper/curl-leaf mountain mahogany/big sagebrush woodland association (PIFinal=4107, 93% based on 15 points), and Sierra lodgepole pine forest alliance (PIFinal=3020, 93% based on 16 points) (Table 9). With the exception of the three mapping classes that were remapped following accuracy assessment (see above), the lowest user's accuracy levels were for canyon live oak/whiteleaf manzanita (PIFinal=1022, 68%, 22 points) and California red fir-white fir forest alliance (PIFinal=4070, 69%, 76 points). Twenty-nine classes at the association level did not reach 80% user's accuracy. Rather than lose information we finalized the mapping product with accuracy levels from 68 to 79% for these types. Global accuracy at the association or equivalent mapping unit level is 81% with 1758 correct out of 2175 assessments. User's accuracy at the association level or equivalent is summarized in Appendix Q.

For the interested user, errors of omission and commission can be calculated from the confusion matrix for any and all types mapped. Errors of omission, the rate at which the type on the ground was not the type specified in the map, is calculated by dividing the number of AA points that fell into types other than the one mapped by the total number of AA points collected for that type. For example, there was a total of 34 AA points in canyon live oak forest alliance (PIFinal=1020), 3 of which were mapped as other types, resulting in an estimated 9% of actual canyon live oak forest alliance being omitted from the map. Errors of commission, the rate at which the type in the map is not that type on the ground, is calculated by taking the number of AA points that fell into polygons mapped as the type in question but were actually other types and dividing it by the total number of AA points mapped as the type in question. For example, 5 AA points mapped as canyon live oak forest alliance were other types on the ground. There were 36 AA points that fell in polygons mapped as canyon live oak forest alliance, so the error of commission is 14%.

Table 9. Types at the association or mapping unit level with the highest and lowest accuracies estimated from 2175 accuracy assessment points within the 1997 vegetation map for Yosemite National Park and environs.

| PIFinal Code | Association/Map Unit Name | % Environs | Number AA Points Correct | Total Number AA Points | % Correct (User's) |
|---|---|---|---|---|---|
| | **Associations/Mapping Units with the Highest Estimated Accuracies** | | | | |
| 5230 | Curl-leaf Mountain Mahogany Woodland Alliance | 0.67 | 35 | 37 | 94 |
| 3020 | Sierra Lodgepole Pine Forest Alliance | 0.22 | 15 | 16 | 93 |
| 4107 | Sierra Juniper/Curl-leaf Mountain Mahogany-Big Sagebrush Woodland Association | 0.50 | 14 | 15 | 93 |
| 5120 | Snowbrush Ceanothus Shrubland Alliance | 0.22 | 14 | 15 | 93 |
| 2520 | White Alder & Bigleaf Maple Forest Superalliance | 0.03 | 11 | 12 | 91 |
| 2010 | Quaking Aspen Forest Alliance | 0.34 | 28 | 31 | 90 |
| 2015 | Quaking Aspen-Jeffery Pine/(Big Sagebrush) Forest Association | 0.08 | 9 | 10 | 90 |
| 3047 | Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Mapping Unit | 0.03 | 9 | 10 | 90 |
| 3072 | Jeffrey Pine/Greenleaf Manzanita Woodland Association | 0.89 | 27 | 30 | 90 |
| 3082 | Jeffery Pine/Curl-leaf Mountain Mahogany Woodland Association | 0.13 | 9 | 10 | 90 |
| 3112 | Single-leaf Pinyon Pine/Curl-leaf Mountain Mahogany-Big Sagebrush-Antelope Bitterbrush Woodland Association | 0.07 | 9 | 10 | 90 |
| | **Associations/Mapping Units with the Lowest Estimated Accuracies** | | | | |
| 1022 | Canyon Live Oak/Whiteleaf Manzanita Forest Association | 1.26 | 15 | 22 | 68 |
| 4070 | California Red Fir-White Fir Forest Alliance | 4.56 | 53 | 76 | 69 |
| 6900 | Mesic Montane Shrubland Mapping Unit | 0.90 | 9 | 13 | 69 |
| 2050 | Black Cottonwood Temporarily Flooded Forest Alliance | 0.01 | 8 | 11 | 72 |
| 2014 | Quaking Aspen/Willow spp. Talus Mapping Unit | 0.23 | 11 | 15 | 73 |
| 3084 | Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association | 0.73 | 14 | 19 | 73 |
| 5110 | Whitethorn Ceanothus Shrubland Alliance | 0.49 | 19 | 26 | 73 |
| 6012 | Deerbrush-Whiteleaf Manzanita Shrubland Association | 0.29 | 11 | 15 | 73 |
| 3097 | Gray Pine-Interior Live Oak/(Whiteleaf Manzanita-Buckbrush-Chamise) Woodland Superassociation | 0.31 | 23 | 31 | 74 |
| 4510 | Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance | 6.71 | 56 | 75 | 74 |

The 91 final mapping classes assessed for accuracy represent 81% of the park and 76% of the park and environs together. Of those assessed proportions, the mapping classes with estimated accuracy of 75% or greater represent 74% of the park and 78% of the park and environs together.

## Map Accuracy Summarized at the Alliance Level

At the alliance level and above, we assessed map accuracy for 48 classes across the entire mapping area (Table 10). To clarify, we collected accuracy assessment data by association or mapping unit but summarized it at both the association and alliance level in the confusion matrix. For example, the number of assessments for Sierra lodgepole pine forest alliance was 272. The number of associations and mapping units assessed under the Sierra lodgepole pine alliance – 10 classes with 9 to 66 assessments each – accounts for the large number of assessments for this alliance.

The highest user's accuracy levels among types with at least eight assessments were for knobcone pine woodland alliance and incense-cedar forest alliance (100% each based on 20 and 8 assessments, respectively) (Table 10). Sierra juniper woodland alliance and curl-leaf mountain mahogany woodland alliance were mapped with high accuracy as well at 94% each based on 54 and 37 assessments, respectively. Among the classes mapped least successfully at the alliance level were California red fir-white fir forest alliance (70%, 76 assessments), whitethorn ceanothus (73%, 26 assessments), and California red fir forest alliance (73%, 104 assessments). There are three classes with lower accuracy estimates, but those were remapped following accuracy assessment (see above). As a result, we do not have their accuracy estimated in the final map. Among the most common classes in the park, two were among those with the lowest accuracies (California red fir-white fir forest alliance, 7% of park, and California red fir forest alliance, 8% of park) and two were mapped with high estimated accuracies. These were Sierra lodgepole pine forest alliance (10% of park) and Jeffrey pine woodland alliance (8% of park) which were mapped at 92% and 81% accuracy, respectively.

Of the 47 alliance-level types assessed, 13 classes were below 80% accuracy (user's accuracy), not including the blue oak type that was remapped (PIFinal=1520). However, results indicate 33 types have greater than 80% accuracy with 12 above 90% accuracy. Global accuracy at the alliance level is 84% with 1828 correct out of 2175 assessments.

### *Positional Accuracy*

Accuracy assessment addressed thematic accuracy only and not positional accuracy. Estimated positional accuracies of the base digital ortho images, to which photointerpretation was rectified, are not available. However, assuming that the DOQs meet USGS standards, the horizontal map accuracy should approach the standard which is 90 percent for all vectors and accurate within 0.05 cm (1/50th of an inch) on the map. At 1:24,000 scale, 1/50th of an inch is 12.2 m (40 ft).

Table 10. Estimated map accuracy at the alliance level or above across the entire mapping area. Global accuracy was 84% with 1825 correct out of 2175 assessments. Types labeled not applicable (n/a) were not assessed. PI Code 1520 includes blue oak woodland alliance, and 4530 includes all but one association within white fir-sugar pine forest alliance.

| PI Code | Alliance/Mapping Unit Common Name | Alliance/Mapping Unit Scientific Name | % YOSE & Environs | Number AA Points Correct | Total Number AA Points | Percent Correct (User's) |
|---|---|---|---|---|---|---|
| ***Forest - Evergreen Forest*** | | | | | | |
| 1020 | Canyon Live Oak Forest Alliance | *Quercus chrysolepis* Forest Alliance | 4.4 | 100 | 115 | 87.0 |
| 1510 | Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit | *Quercus chrysolepis*/*Aesculus californica* Woodland & *Quercus wislizeni-Aesculus californica* Shrubland Mapping Unit | 0.2 | 14 | 16 | 87.5 |
| 3010 | Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Forest Mapping Unit | *Pinus contorta* var. *murrayana-Populus tremuloides*-(*Pinus jeffreyi*) Forest Mapping Unit | 0.2 | 28 | 32 | 87.5 |
| 3020 | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta* var. *murrayana* Forest Alliance | 4.3 | 249 | 272 | 91.5 |
| 3060 | Ponderosa Pine-Incense-cedar Forest Alliance | *Pinus ponderosa-Calocedrus decurrens* Forest Alliance | 5.9 | 90 | 105 | 85.7 |
| 4010 | Douglas-fir Forest Alliance | *Pseudotsuga menziesii* Forest Alliance | 0.2 | 16 | 19 | 84.2 |
| 4020 | Giant Sequoia Forest Alliance | *Sequoiadendron giganteum* Forest Alliance | 0.0 | 0 | 0 | n/a |
| 4030 | Mountain Hemlock Forest Alliance | *Tsuga mertensiana* Forest Alliance | 3.8 | 79 | 92 | 85.9 |
| 4050 | California Red Fir Forest Alliance | *Abies magnifica* Forest Alliance | 6.6 | 76 | 104 | 73.1 |
| 4070 | California Red Fir-White Fir Forest Alliance | *Abies magnifica-Abies concolor* Forest Alliance | 4.6 | 53 | 76 | 69.7 |
| 4110 | Incense-cedar Forest Alliance | *Calocedrus decurrens* Forest Alliance | 0.0 | 8 | 8 | 100.0 |
| 4510 | Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance | *Pinus monticola*-(*Abies magnifica-Pinus contorta* var. *murrayana*) Forest Superalliance | 6.7 | 56 | 75 | 74.7 |
| 4520 | White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/(Pinemat Manzanita-Whitethorn Ceanothus) Forest Mapping Unit | *Abies concolor*-(*Abies magnifica-Pinus lambertiana-Pinus jeffreyi*)/(*Arctostaphylos nevadensis-Ceanothus cordulatus*) Forest Mapping Unit | 1.0 | 28 | 37 | 75.7 |
| 4530 | White Fir-Sugar Pine-(Incense-cedar-Jeffrey Pine) Mapping Unit | *Abies concolor-Pinus lambertiana*-(*Calocedrus decurrens-Pinus jeffreyi*) Mapping Unit | 4.8 | 64 | 82 | 78.0 |

| PI Code | Alliance/Mapping Unit Common Name | Alliance/Mapping Unit Scientific Name | % YOSE & Environs | Number AA Points Correct | Total Number AA Points | Percent Correct (User's) |
|---|---|---|---|---|---|---|
| 4550 | Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit | *Pseudotsuga menziesii*-(*Abies concolor-Calocedrus decurrens-Pinus ponderosa*) Forest Mapping Unit | 0.8 | 20 | 26 | 76.9 |
| ***Forest - Deciduous Forest*** | | | | | | |
| 2010 | Quaking Aspen Forest Alliance | *Populus tremuloides* Forest Alliance | 1.2 | 88 | 99 | 88.9 |
| 2020 | California Black Oak Forest Alliance | *Quercus kelloggii* Forest Alliance | 1.0 | 45 | 50 | 90.0 |
| 2050 | Black Cottonwood Temporarily Flooded Forest Alliance | *Populus balsamifera* var. *trichocarpa* Temporarily Flooded Forest Alliance | 0.0 | 11 | 14 | 78.6 |
| 2510 | Willow spp. Forest Mapping Unit | *Salix* spp. Forest Mapping Unit | 0.0 | 1 | 1 | 100.0 |
| 2520 | White Alder & Bigleaf Maple Forest Superalliance | *Alnus rhombifolia* & *Acer macrophyllum* Forest Superalliance | 0.0 | 11 | 12 | 91.7 |
| ***Woodland - Evergreen Woodland*** | | | | | | |
| 1040 | Interior Live Oak Woodland Alliance | *Quercus wislizeni* Woodland Alliance | 0.1 | 22 | 27 | 81.5 |
| 3050 | Ponderosa Pine Woodland Alliance | *Pinus ponderosa* Woodland Alliance | 1.0 | 34 | 40 | 85.0 |
| 3070 | Jeffrey Pine Woodland Alliance | *Pinus jeffreyi* Woodland Alliance | 6.1 | 138 | 170 | 81.2 |
| 3090 | Gray Pine Woodland Alliance | *Pinus sabiniana* Woodland Alliance | 0.5 | 32 | 38 | 84.2 |
| 3100 | Knobcone Pine Woodland Alliance | *Pinus attenuata* Woodland Alliance | 0.1 | 20 | 20 | 100.0 |
| 3110 | Singleleaf Pinyon Pine Woodland Alliance | *Pinus monophylla* Woodland Alliance | 0.4 | 21 | 24 | 87.5 |
| 3130 | Western White Pine Woodland Alliance | *Pinus monticola* Woodland Alliance | 1.0 | 22 | 28 | 78.6 |
| 3140 | Whitebark Pine Woodland Alliance | *Pinus albicaulis* Woodland Alliance | 5.8 | 115 | 127 | 90.6 |
| 3150 | Limber Pine Woodland Alliance | *Pinus flexilis* Woodland Alliance | 0.0 | 0 | 0 | n/a |
| 4100 | Sierra Juniper Woodland Alliance | *Juniperus occidentalis* var. *australis* Woodland Alliance | 2.8 | 51 | 54 | 94.4 |
| ***Woodland - Deciduous Woodland*** | | | | | | |
| 1520 | Blue Oak-(Interior Live Oak-Gray Pine/Buckbrush/Annual Grass) Woodland Mapping Unit | *Quercus douglasii*-(*Quercus wislizeni-Pinus sabiniana*/*Ceanothus cuneatus*/Annual Grass) Woodland Mapping Unit | 0.0 | 6 | 14 | 42.9 |
| 2040 | Valley Oak Woodland Alliance | *Quercus lobata* Woodland Alliance | 0.0 | 0 | 0 | n/a |
| ***Shrubland - Evergreen Shrubland*** | | | | | | |
| 5020 | Chamise Shrubland Alliance | *Adenostoma fasciculatum* Shrubland Alliance | 0.1 | 7 | 8 | 87.5 |
| 5040 | Interior Live Oak Shrubland Alliance | *Quercus wislizeni* Shrubland Alliance | 0.0 | 6 | 8 | 75.0 |

| PI Code | Alliance/Mapping Unit Common Name | Alliance/Mapping Unit Scientific Name | % YOSE & Environs | Number AA Points Correct | Total Number AA Points | Percent Correct (User's) |
|---|---|---|---|---|---|---|
| 5060 | Chaparral Whitethorn Shrubland Alliance | *Ceanothus leucodermis* Shrubland Alliance | 0.0 | 0 | 0 | n/a |
| 5110 | Whitethorn Ceanothus Shrubland Alliance | *Ceanothus cordulatus* Shrubland Alliance | 0.5 | 19 | 26 | 73.1 |
| 5120 | Snowbrush Ceanothus Shrubland Alliance | *Ceanothus velutinus* Shrubland Alliance | 0.2 | 14 | 15 | 93.3 |
| 5130 | Mountain Misery Dwarf-shrubland Alliance | *Chamaebatia foliolosa* Dwarf-shrubland Alliance | 0.2 | 13 | 15 | 86.7 |
| 5160 | Big Sagebrush Shrubland Alliance | *Artemisia tridentata* Shrubland Alliance | 0.5 | 17 | 22 | 77.3 |
| 5210 | Low Sagebrush Dwarf-shrubland Alliance | *Artemisia arbuscula* Dwarf-shrubland Alliance | 0.2 | 25 | 30 | 83.3 |
| 5230 | Curl-leaf Mountain Mahogany Woodland Alliance | *Cercocarpus ledifolius* Woodland Alliance | 0.7 | 35 | 37 | 94.6 |
| 5240 | Antelope Bitterbrush Shrubland Alliance | *Purshia tridentata* Shrubland Alliance | 2.7 | 29 | 35 | 82.9 |
| 5250 | (Silver Lupine)/Brome spp. Shrubland Mapping Unit | (*Lupinus albifrons*)/*Bromus* spp. Shrubland Mapping Unit | 0.0 | 4 | 4 | 100.0 |
| 5260 | Big Sagebrush-(Silver Sagebrush) Shrubland Mapping Unit | *Artemisia tridentata*-(*Artemisia cana*) Shrubland Mapping Unit | 0.0 | 0 | 0 | n/a |
| 5510 | Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance | *Artemisia tridentata* ssp. *vaseyana* & *Artemisia rothrockii* & *Holodiscus discolor* & *Phyllodoce breweri* Shrubland Superalliance | 0.5 | 20 | 24 | 83.3 |
| 5560 | Chamise-(Buckbrush-Whiteleaf Manzanita) Shrubland Mapping Unit | *Adenostoma fasciculatum*-(*Ceanothus cuneatus*-*Arctostaphylos viscida*) Shrubland Mapping Unit | 0.4 | 18 | 24 | 75.0 |
| 5570 | Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Superalliance | *Arctostaphylos patula* & *Chrysolepis sempervirens* & *Quercus vaccinifolia* Shrubland Superalliance | 2.3 | 58 | 72 | 80.6 |
| 5580 | Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance | *Cercocarpus betuloides* & *Ceanothus cuneatus* & *Arctostaphylos viscida* Shrubland Superalliance | 0.2 | 24 | 27 | 88.9 |
| ***Shrubland - Deciduous Shrubland*** | | | | | | |
| 6010 | Deerbrush Shrubland Alliance | *Ceanothus integerrimus* Shrubland Alliance | 0.4 | 20 | 25 | 80.0 |
| 6110 | Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance | *Salix orestera*/*Allium validum*Seasonally Flooded Shrubland Alliance | 0.7 | 2 | 2 | 100.0 |

| PI Code | Alliance/Mapping Unit Common Name | Alliance/Mapping Unit Scientific Name | % YOSE & Environs | Number AA Points Correct | Total Number AA Points | Percent Correct (User's) |
|---|---|---|---|---|---|---|
| 6500 | Willow spp//Meadow Shrubland Mapping Unit | *Salix* spp.//Meadow Shrubland Mapping Unit | 0.2 | 0 | 0 | n/a |
| 6600 | Willow spp. Riparian Shrubland Mapping Unit | *Salix* spp. Riparian Shrubland Mapping Unit | 0.3 | 0 | 0 | n/a |
| 6700 | Willow spp. Talus Shrubland Mapping Unit | *Salix* spp. Talus Shrubland Mapping Unit | 0.5 | 0 | 0 | n/a |
| 6900 | Mesic Montane Shrubland Mapping Unit | Mesic Montane Shrubland Mapping Unit | 0.9 | 9 | 13 | 69.2 |
| ***Herbaceous Vegetation - Annual*** | | | | | | |
| 7260 | California Annual Grassland/Herbland Superalliance | California Annual Grassland/Herbland Superalliance | 0.0 | 7 | 8 | 87.5 |
| ***Herbaceous Vegetation - Perennial*** | | | | | | |
| 7120 | Shorthair Sedge Herbaceous Alliance | *Carex exserta* Herbaceous Alliance | 0.8 | 0 | 0 | n/a |
| 7550 | Upland graminoids | Upland graminoids | 0.1 | 0 | 0 | n/a |
| 7701 | Post-clearcut Shrub/Herbaceous Mapping Unit | Post-clearcut Shrub/Herbaceous Mapping Unit | 0.0 | 0 | 0 | n/a |
| 7702 | Mesic Post-fire Herbaceous Mapping Unit | Mesic Post-fire Herbaceous Mapping Unit | 0.2 | 0 | 0 | n/a |
| 8000 | Intermittently to Seasonally Flooded Meadow | Intermittently to Seasonally Flooded Meadow | 1.8 | 3 | 3 | 100.0 |
| 9000 | Semi-permanently to Permanently Flooded Meadow Mapping Unit | Semi-permanently to Permanently Flooded Meadow Mapping Unit | 0.2 | 0 | 0 | n/a |
| | | | | 1828 | 2175 | 84 |

## The Final Vegetation Map for Yosemite National Park and Environs

The final vegetation map is available as a portable document format (pdf) file and as a spatial data coverage (Figures 4, 5 and 6) through the NPS Vegetation Inventory Program web site (http://science.nature.nps.gov/im/inventory/veg/index.cfm). Map unit descriptions are in Appendix O. Appendix P provides a cross walk between the mapping classification and the floristic classification where additional details are available on range, environmental setting, and species composition for types that nest within mapping units (Appendix K). Complete metadata are packaged with the digital map, and field definitions can be found in Appendix R.

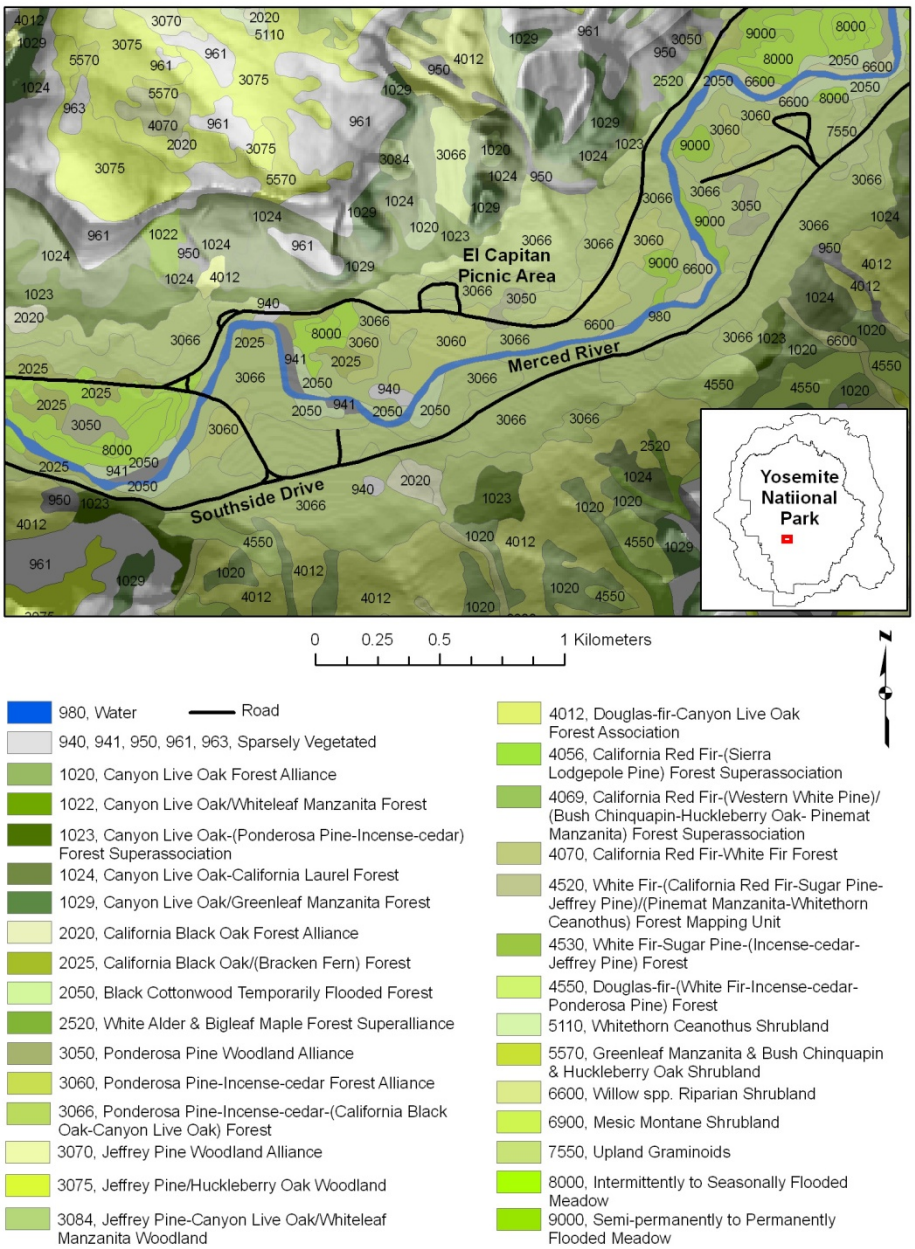


Figure 4. A portion of the final 1997 vegetation map of Yosemite National Park within Yosemite Valley displays the complexity of vegetation and how it varies with environmental setting.

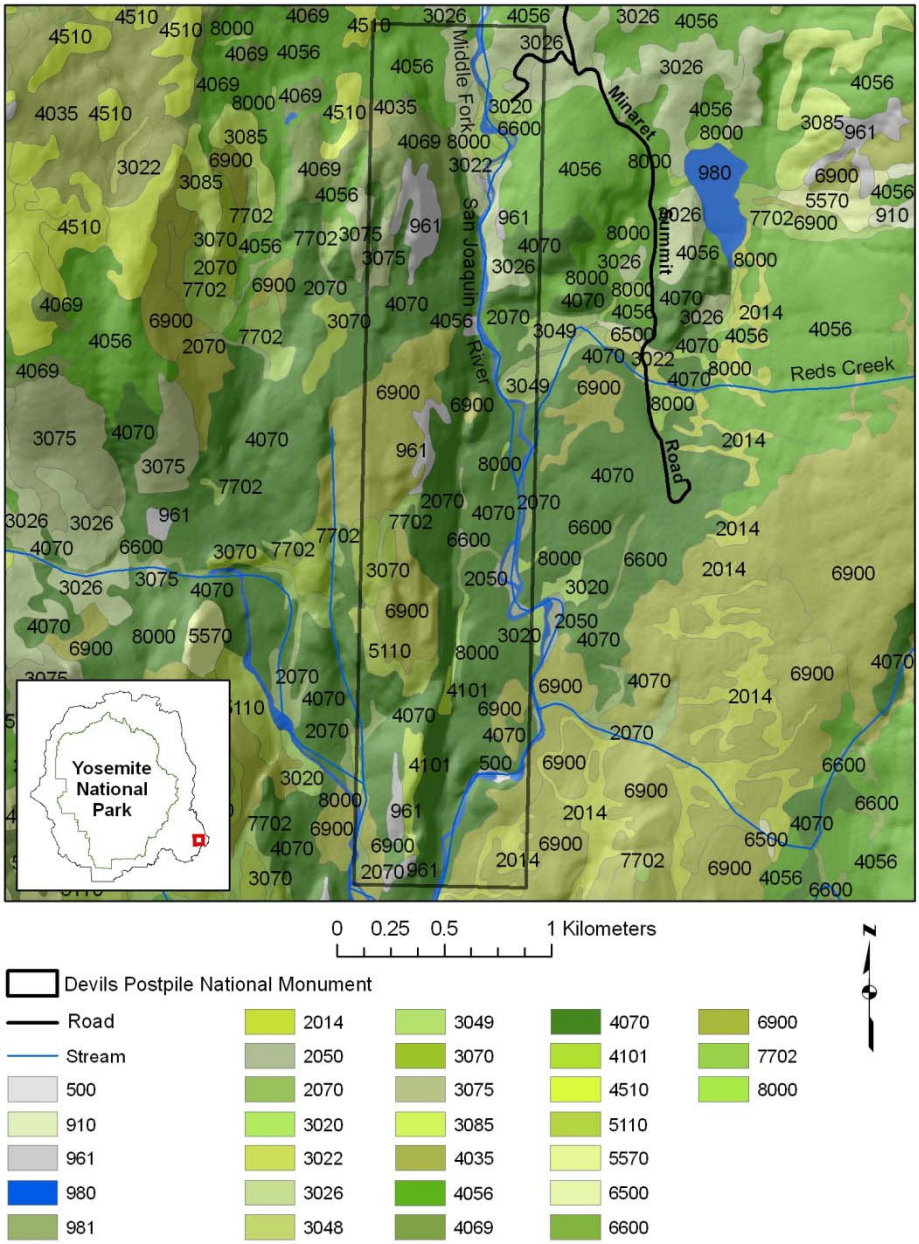


Figure 5. A portion of the final 1997 vegetation map of Yosemite National Park and environs displaying the vegetation in and around Devils Postpile National Monument. See Appendix H for code definitions.

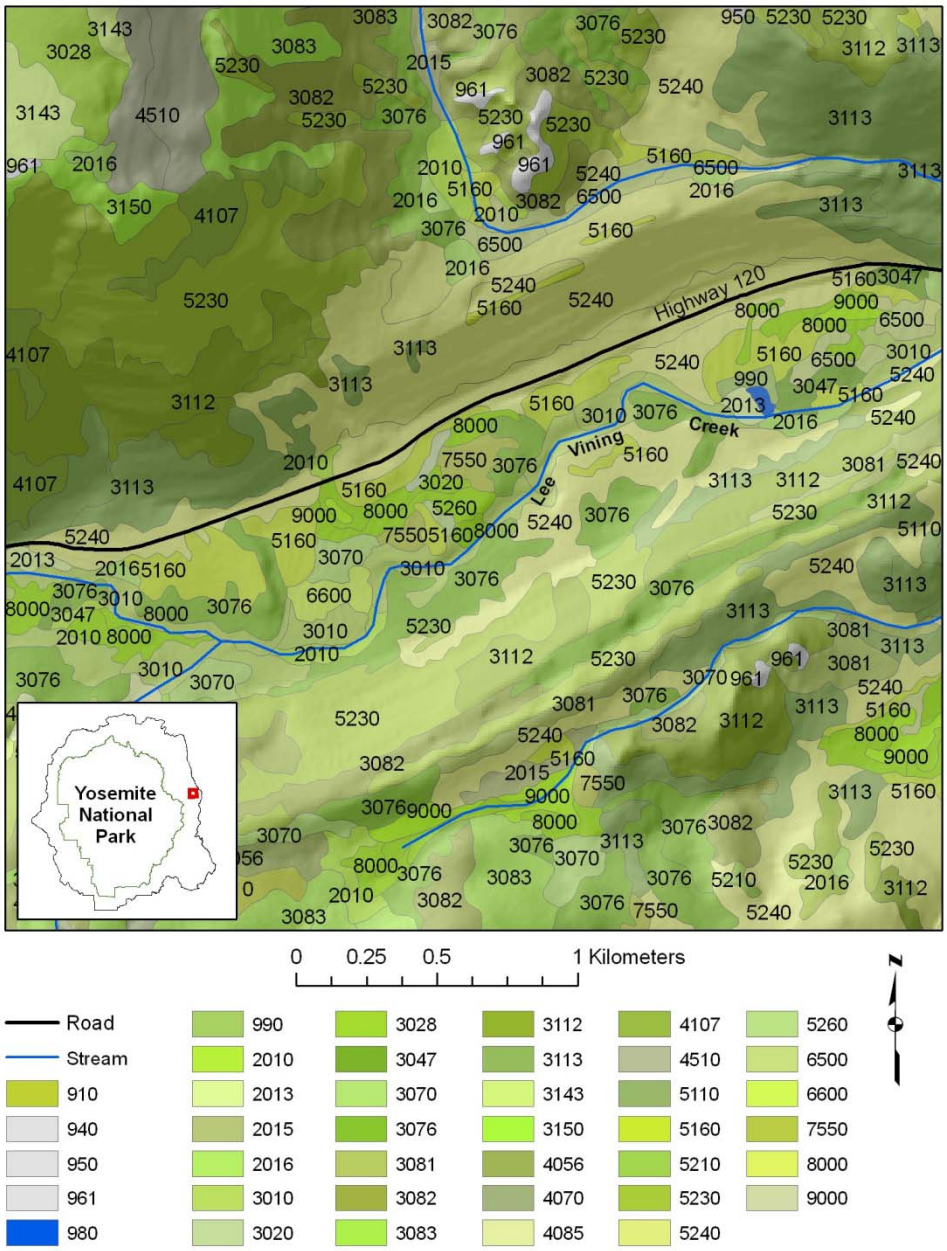


Figure 6. A portion of the 1997 vegetation map of Yosemite National Park and environs displaying an example of the vegetation in the eastern portion of the environs in Lee Vining Canyon. See Appendix H for code definitions.

# Discussion

## The Vegetation Mapping Process

### *Things That Worked Well*

Existing plot data were valuable for informing the classification and for providing guidance to photointerpreters. Assembling and analyzing legacy data helped corroborate vegetation classification results from new samples and contributed directly to sample sizes in the classification even though some data sets, due to their age, were not useful in mapping existing vegetation.

Taking advantage of expertise among local ecologists regarding the pattern and distribution of vegetation and its drivers provided insights in developing a preliminary classification and helped guide analysis for developing biophysical units to allocate sampling. Similarly, field reconnaissance involving both photointerpreters and project ecologists provided the basis for developing the mapping classification, provided opportunities to accurately capture photo signatures matched to vegetation types identified by ecologists in the field, and provided photointerpreters with insights into the environmental settings of various types.

Other large parks and preserves may benefit from an analysis of biophysical units to guide ecological sampling. If the physical parameters that drive the diversity of the local vegetation can be approximated with spatial data, sampling efficiency can be maximized. Those areas with the least amount of existing field data may reap the largest benefit. If vegetation sampling is driven from the beginning by biophysical and cost surface analysis, nearly every sample collected could be useful for mapping and/or classification. The time and effort invested in setting up the spatial analysis would be amply compensated by the efficiency of the field sampling effort.

### *Areas for Improvement*

We made the decision to develop a floristic classification at the finest level the sample data would support while simultaneously developing a mapping classification that included only photointerpretable types. The value of the floristic classification is a greater understanding of plant community diversity throughout the park and environs. It is a tool for multi-species conservation, a basis for identifying rare vegetation types, an inventory of homogeneous units that can serve as targets for management prescriptions (e.g., fire management, other restoration activities), and a baseline regarding composition and structure in the face of climate change (see a fuller treatment of these issues in Sawyer et al. [2009]). However, the need to cross-walk from the floristic classification and key to the mapping product created inefficiencies within the project and continues to be a source of complexity that is challenging to convey to users. It added a step in the analysis of accuracy assessment data because AA points were keyed to types in the floristic classification which then needed cross walking to the mapping classification. In the end, having both a fairly comprehensive floristic classification and a mapping classification is powerful, with each product supporting different management needs.

Developing the vegetation classification concurrently with the mapping classification had the advantage of providing early input to the mapping classification. It had the disadvantage of producing drafts of the mapping classification well before the vegetation classification was fully populated and before all samples were collected and integrated into the classification. So, early

in the process, the mapping classification did not have a stable target for identifying the types to be mapped and needed revision as the vegetation classification was developed.

Mapping was a carefully orchestrated process of preliminary photointerpretation, field reconnaissance with aerial photos in hand, draft mapping of select areas by elevation zone, field verification by elevation zone, and use of available ancillary data prior to final photointerpretation. Nevertheless, pilot mapping of a portion of the park and environs, including accuracy assessment, might have reduced the number of mapping types in the final map for which we could not meet the program standard for accuracy. Examples include some common and extensive types such as California red fir-white fir forest alliance and California red fir forest alliance.

### Vegetation Classification

Insufficient classification work had been completed in the central and southern Sierra Nevada to allow us to rely on existing treatments to characterize Yosemite area vegetation. Work by Forest Service ecologists was invaluable, including that of Don Potter for the upper montane zone and that of Jo Ann Fites-Kauffman (1993) for the lower montane zone of the northern Sierra Nevada which has analogs in the Yosemite region. Some of the original work that came out of the Yosemite classification was the division of what had commonly been termed Sierra mixed-conifer forest into a ponderosa pine-incense-cedar alliance at lower elevations and a white fir-sugar pine alliance at higher elevations (Keeler-Wolf et al., 2003). This refinement allowed the Yosemite classification to meet the U.S. National Vegetation Classification Standard (FGDC, 2008:8) requirement for these forest types of having a floristic basis for the lowest levels of the USNVC (alliance and association).

Classification work on Sierra Nevada shrublands was particularly scarce at the beginning of this project, particularly that of montane chaparral of the western slope and big sagebrush (*Artemisia tridentata*) and associates of the eastern slope. Pure stands of whitethorn ceanothus and deerbrush that establish following high severity fire in the conifer zone were easily sampled and classified. Montane chaparral associations with combinations of huckleberry oak, bush chinquapin, and greenleaf manzanita were more challenging to classify and associate with environmental settings. Difficulty in distinguishing them in aerial photography, however, was the main contributor to lower accuracy levels for some of these montane shrublands (e.g., 5110, whitethorn ceanothus shrubland alliance at 73%), and this resulted in the need to aggregate types (e.g., 5570, greenleaf manzanita & bush chinquapin & huckleberry oak shrubland superalliance) to achieve acceptable levels of accuracy.

In contrast, there was some work available describing temporarily flooded cold-deciduous shrublands. Potter (2000 ms) described a single Lemmon's willow shrubland, and Taylor (1984) listed three Sierra willow associations, and a tea-leaf willow/Rocky Mountain sedge shrubland. We add a provisional narrow-leaf willow/rush shrubland, a provisional arroyo willow-canyon live oak/spice bush association, an Eastwood's willow shrubland, a provisional dusky willow shrubland, and an additional tea-leaf willow shrubland distinguished by the presence of other woody species that may include Eastwood’s willow, Sierra bilberry, and bog laurel and the absence of Rocky Mountain sedge.

We present the first classification work for the bitterbrush-sagebrush zone of the lower eastern slope of the Sierra Nevada. Where we expected dominance by big sagebrush to be extensive at the lowest elevations, sampling showed big sagebrush alliance to be the exception and antelope bitterbrush alliance to be more common (based on our rule that co-dominance between antelope bitterbrush and big sagebrush would place vegetation in the antelope bitterbrush alliance). We describe the big sagebrush, antelope bitterbrush, and snowbrush ceanothus alliances from low elevation, Great Basin settings; the silver sagebrush alliance from low elevation mesic settings associated with meadows; and low sagebrush, timberline sagebrush, and mountain big sagebrush alliances from high elevations near treeline.

Finally, the western slope foothills presented an array of woodland and chaparral vegetation needing classification. Allen et al. (1991) provided a comprehensive treatment of California oak woodlands to which we were able to add samples and verify local occurrence. Original work was needed for gray pine, California black oak (in part), black cottonwood, chamise, and deerbrush, among others. There are several new associations in the classification for quaking aspen, gray pine, singleleaf pinyon, and whitebark pine.

Another large group of newly defined associations is among the wet meadow communities for which there were approximately eight new associations defined. We had insufficient samples to define associations for tufted hairgrass, one of the more important wet meadow alliances, but we were able to incorporate previously defined types or define provisional associations for most of the other common wet and mesic meadow types in the region. The latter include shorthair reedgrass, shorthair sedge, timber oatgrass, bristly sedge, and Nebraska sedge alliances.

Although this project used the 1997 version of the USNVC hierarchy (Table 1) (Grossman et al., 1998), modifications should not be needed at the lower levels of the classification (alliance and association) for Yosemite and environs to convert it to the 2008 hierarchy (FGDC, 2008). The National Vegetation Classification Standard (FGDC, 2008:8) discusses the changes that have occurred in the USNVC. To apply the new USNVC hierarchy, if desired, there is a draft in Appendix 3 of Sawyer, Keeler-Wolf, and Evens (2009) that can provide guidance for placing all the alliances listed in this report. Also, the USNVC Hierarchy Explorer is available at http://usnvc.org/explore-classification/.

The large size and diverse habitats of the park and environs and lack of previous sampling for many of the habitats resulted in a classification that is ambitious in its scope but insufficiently sampled for many of the types presented. Our hope is that it lays the groundwork for additional sampling to refine our understanding of Sierra Nevada vegetation (types needing additional sampling are listed in Appendix L).

## The Vegetation within Yosemite National Park

Yosemite is largely a forested and wooded landscape with three quarters of the park (74%) mapped as forest or woodland. Approximately 75% of Yosemite lies within the middle elevation montane zone (between 1,000 and 3,000 m). This is the zone of deeper soils below the more glacially scoured alpine landscape. Approximately 7.6% of Yosemite was mapped as alpine habitats. The low representation of foothill chaparral shrubland types reflects how little foothill habitat lies within Yosemite which has less than 0.3% below 1000 m.

In contrast, Sequoia and Kings Canyon national parks in the southern Sierra Nevada (two contiguous units of the National Park Service that are jointly administered) have 55% mapped as forest or woodland, 32% of the landscape mapped as alpine, and 1.8% mapped as foothill chaparral shrublands. Sequoia and Kings Canyon have more high-elevation terrain than Yosemite and more foothill habitat, and the Sierra Nevada is broader within those parks with a steep western slope that compresses the forested zone to a narrower band.

There were few surprises regarding the most common forest types within the park. Sierra lodgepole pine forest alliance, Jeffrey pine woodland alliance, and California red fir forest alliance are the most commonly encountered forest types. However, there was a higher diversity of associations within these alliances than expected. For example, the 11 associations within Sierra lodgepole pine forest alliance span a moisture gradient represented by Sierra lodgepole pine/western Labrador tea at the wettest sites to Sierra lodgepole pine/mountain pride at the most xeric end of the gradient. Within this gradient there was wide variation in structure, composition and environmental setting. The diversity within California red fir alliance and its nine associations was greater than anticipated as well. The high proportion of sparsely vegetated area also came as no surprise to anyone familiar with the Yosemite landscape and its abundant glacially sculpted features.

The limited extent of mapped evergreen shrublands may in part reflect the decades-long era of fire suppression (Nagel and Taylor, 2005). Mapped over 3.6% of the park, a relatively small percent of the landscape is dominated by shrublands that establish following high severity fire in montane forests (e.g., whitethorn ceanothus). This is in spite of NPS policies during the last 40 years in support of fire as an active natural process in western landscapes. At the same time, this compares with 1.9% of the park mapped as evergreen shrublands in the 1937 vegetation type map which was completed toward the beginning of the fire suppression era. It may be that different mapping methodologies, base maps, and scales preclude accurate comparison of shrubland abundance between the two maps. It may also be that soil depth has as large a role as fire in driving shrubland distribution.

The overall diversity of vegetation within Yosemite reflects the dramatic topographic-climatic-edaphic gradient that parallels the western slope from the foothills to the crest of the range. Temperature and moisture patterns parallel the increase in elevation. Within that context, the diverse macro and micro topography drives the distribution of water supply (e.g., due to precipitation and soil depth) and evaporative demand (e.g., due to aspect) which in turn drive the distribution of vegetation (Stephenson 1998). Fites-Kaufman et al. (2007) provide a succinct treatment of how water balance within the context of mountain climate influences vegetation distribution and how factors such as elevation and moisture gradient are simply surrogates for climate and site water balance. This elucidation of direct explanatory factors brings into focus what we observe on the landscape and what the vegetation map attempts to capture.

### The Vegetation across the Entire Mapping Area

The entire mapping area, including beyond the boundaries of Yosemite, consisted of a slightly lower percentage of forest and woodland (69%) compared with the park (74%) and a slightly higher percentage of shrubland (11%). This is strongly influenced by the inclusion of the west slope foothill chaparral zone and the east slope sagebrush-bitterbrush zone. Examples of classes mapped within the environs but not within the park include blue oak, valley oak, Oregon oak,

and knobcone pine types of the western foothills; riparian and Jeffrey pine types of the lower eastern slope; limber pine of the higher eastern slope; and antelope bitterbrush, snowbrush ceanothus, and big sagebrush types of the lower eastern slope. In contrast, the Sequoia and Kings Canyon map, which was limited to the park boundaries, included blue oak in the western foothills and limber pine near the crest (in addition to other foothill deciduous [e.g., California sycamore) and needleleaf evergreen pine [e.g., foxtail pine] types not occurring in Yosemite.

### The Vegetation within Devils Postpile National Monument

The current expression of vegetation within DEPO is significantly affected by a wildfire that occurred there in 1992. The aerial photography showed high and moderate fire severities within the southern and western portions of the monument, and the fire likely reduced the proportion of California red fir-white fir forest and likely increased the proportion of mesic montane shrubland mapped based on the 1997 photography (Figure 7).

One of the most important shrubland types within the mesic montane shrubland mapping unit is bitter cherry (*Prunus emarginata*), a common shrub following fire in mesic settings.

Also, the valley bottom setting of DEPO contributes to a higher proportion of California red fir and mesic shrubland types and a lower proportion of forest and woodland types that occur on shallower soils and on middle and upper slopes such as Jeffrey pine woodland, Sierra juniper woodland, and western white pine forest.

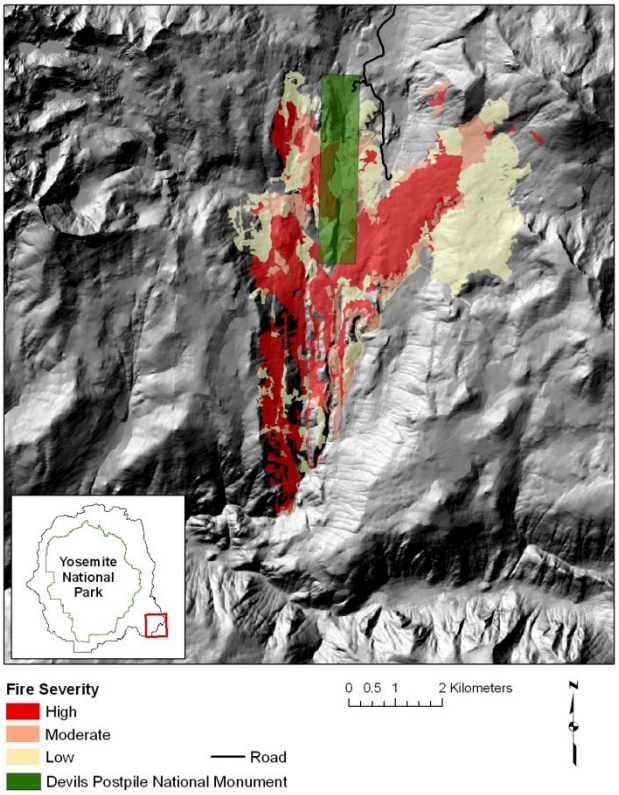


Figure 7. High, moderate, and low fire severity was evident in 1997 aerial photography stemming from a 1992 fire that burned in and around Devils Postpile National Monument.

### Thematic Map Accuracy

Photointerpretation achieved the highest thematic map accuracies for types with more open canopies. In addition to Sierra lodgepole pine alliance, curl-leaf mountain mahogany alliance, and Sierra juniper/curl-leaf mountain mahogany/big sagebrush association, this included two Jeffrey pine woodland associations, a single-leaf pinyon pine association, two quaking aspen types, and a Sierra lodgepole pine mapping unit (Table 9). Sparser canopies allowed photointerpreters to use canopy characteristics more effectively to distinguish dominant species; the closed canopies of California red fir-white fir forest alliance and canyon live oak/whiteleaf manzanita likely contributed to lower estimated user's accuracy of 69% and 68%, respectively.

Thirty-two mapping types of 91 assessed for accuracy did not meet the 80% map accuracy program standard. Although three types were remapped using better information on photo signature and distribution, the remaining types were retained as mapped with 68% to 79% accuracy. Remapping would have precluded the availability of valid accuracy estimates for these types.

## Utility of the Map

At the time of its completion in 2006, the final map for YOSE and environs represented the most accurate and highest resolution vegetation map available. As the first vegetation map produced for the entire park since 1937, it provides a valuable tool for resource managers in the region for a wide variety of applications. Various applications of the map have included:

- Rare plant species habitat modeling
- Modeling vegetation change in response to climatic change
- Mapping distribution of fuel models to support fire spread modeling
- American black bear habitat mapping
- Carbon sequestration
- Archaeological site prediction
- Vista management

For example, rare plant species habitat models based on topographic characteristics, substrate, fire history, and vegetation type were 44% to 73% successful in predicting occupied habitat based on model verification (Moore et al., 2010). These efforts as much as doubled the number of documented rare plant populations in the park for selected species. In combination with plot data on stand structure, the vegetation map is being used to estimate above-ground carbon stocks in park forests. The vegetation map has also served as the basis for a revised fuels map which is used, along with topography and weather, for dynamic fire spread modeling (K. van Wagtendonk, NPS, pers. comm.). Recent vista management planning used features in the vegetation map to draft prescriptions for retaining historic views within Yosemite Valley and elsewhere in the park (K. McCardle, NPS, pers comm.).

## Map Updates

The map will continue to be a valuable tool in the future. It will prove most useful, however, if it is updated with changes resulting from fire and other factors that modify vegetation structure and composition. For example, high severity fire within California red fir stands commonly results in whitethorn ceanothus shrubland within a few years, and high severity fire within ponderosa pine-incense-cedar alliance commonly results in deerbrush shrublands that persist for some years. Resources that would be valuable for updates include finer scale ortho imagery. It may be feasible to add structural information to mapped vegetation using recent remote sensing technologies such as Light Detection and Ranging (LIDAR). Updates may also take the form of corrections to map attributes based on ground verification. For example, meadows are gaining increased scientific and management attention in the Sierra Nevada. Recent efforts at assessing meadow condition included some ground verification efforts to improve the accuracy of meadow distribution and extent within Yosemite.

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# Appendix A: Project Timeline

Vegetation Inventory and Type Mapping Project, Yosemite National Park

| Year | Period | Task |
|---|---|---|
| 1996 | September | Scoping meeting at Yosemite – NatureServe, NPS, ESRI, AIS & USGS |
| 1997 | May | Gradsect analysis (Gillison & Brewer 1985) undertaken by NatureServe for YOSE & environs |
| | August | Aerial photography flown for YOSE and environs |
| 1998 | January | Preliminary vegetation classification developed by USGS and DFG ecologists using the existing Manual of California Vegetation (Sawyer & Keeler-Wolf 1995) and other published work |
| | May-September | First year of releve field plot collection by YOSE/ NatureServe field crew – data from 264 plots collected |
| 1999 | February | Coordination meeting at YOSE – AIS displays sample rectified delineations for 7 aerial photos |
| | April | First AIS field reconnaissance with ecologists for low elevation zones 1 & 2<br>Preliminary mapping classifications developed for zones 1 & 2 |
| | May | Second AIS field reconnaissance with ecologists for east slope zones 7 & 8<br>Preliminary mapping classifications developed for zones 7 & 8 |
| | April – September | Preliminary photointerpretation of 350 photos by AIS to assist second season field crews in sampling effort |
| | May-September | Second year of releve field plot collection by YOSE/ NatureServe field crew– data from 340 plots collected |
| | June-July | Third AIS field reconnaissance with ecologists for mixed conifer zones 3 & 4<br>Preliminary mapping classifications developed for zones 3 & 4 |
| | August | Fourth AIS field reconnaissance with ecologists for alpine zones 5 & 6<br>Preliminary mapping classifications developed for zones 5 & 6 |
| 2000 | July | Vegetation plot analysis and classification undertaken by NatureServe |
| | September | Draft vegetation classification developed by NatureServe |
| | November | Revised draft vegetation classification completed by NatureServe<br>Landuse & fire-modifier classifications developed<br>Mapping descriptions developed |
| | October | Photointerpretation production begins for YOSE & environs |
| | November | Pilot areas for 4 regions delineated and automated for NPS review |
| 2001 | January | Automation procedures begin for completed photos |
| | September-December | Final vegetation classification, keys and descriptions completed |
| | December | First field verification effort for zones 1 & 2 |
| 2002 | May | Final mapping for shipment 1 & 2 delivered |
| | June | Second field verification efforts for zones 3 & 4<br>Final mapping for shipments 3 & 4 delivered |
| | July | Final mapping for shipment 5 delivered |
| | August | Final mapping for shipments 6,7 & 8 delivered |
| | September | Mapping to vegetation classification crosswalk table completed<br>Third field verification efforts for zones 7 & 8<br>Final mapping for shipments 9 & 10 delivered |
| | October | Final mapping for shipments 11 & 12 delivered |
| | November | Photointerpretation production completed for YOSE & environs |

| Year | Period | Task |
|---|---|---|
| | | Final mapping for shipments 13 & 14 delivered |
| | December | Final mapping for shipments 14.5, 15, 15.5 & 16 delivered |
| 2003 | January | Final mapping for shipments 17 & 18 delivered |
| | February | Automation production complete for YOSE & environs<br>Final database delivery<br>Final mapping for shipments 19, 20 & 21 delivered |
| | March | Classification finalized |
| 2006 | March | Accuracy Assessment database delivered to AIS |
| | July | Initial review of AA database completed by AIS |
| | December | Mapping class aggregations and AA results accepted by NPS |
| 2007 | April | Final methodology report and mapping classification descriptions complete<br>Crosswalk and history complete |

# Appendix B: Development of the Gradsect

**A geographic information system based gradient-directed transect (gradsect) approach for stratifying vegetation sampling**

To develop a vegetation map and classification specific to Yosemite National Park and environs, it was necessary to establish ecological plots to supplement and fill in gaps in the existing data sets. The extreme size and varied terrain of the Yosemite region required carefully locating plots to efficiently capture the full spectrum of vegetation types. A gradsect analysis (Gillison and Brewer 1985) utilizing spatial representations of the environmental variables associated with the region's vegetative diversity was used to help determine plot placement.

In May of 1997 a consortium of USGS, NPS, NatureServe, and California Heritage ecologists familiar with the vegetation of Yosemite selected the environmental variables thought to be the most important drivers of the region's vegetative diversity. This was a concensus of expert opinion for the purpose of stratifying the landscape to obtain a diversity of samples. The salient variables were slope, aspect, elevation, geology, hydrology, the east–west gradient in climate, and fire history. These environmental variables were then used to develop a spatial model predictive of potential vegetative diversity. Suitable classes were determined for each of these variables. A 30-meter digital elevation model (DEM) of the park and environs was used to calculate the slope, aspect, and elevation grids. NPS staff also provided coverages of the region's hydrology and geology. These coverages were converted into grids with the same cell size and reference coordinates as the DEM. All coverages and grids were in the UTM Zone 11 coordinate system, NAD27 datum. All coverages and grids were clipped to the boundary of the environs as provided by NPS staff. Each grid was then reclassified into the classes established by the ecologists. Fire history was available for the park but not available for the environs at the time of this analysis. The remaining five grids were combined to form the initial Biophysical Units (BPUs), which would be used to stratify sampling. A neighborhood analysis was performed on the Biophysical Unit grid to determine areas of high physical

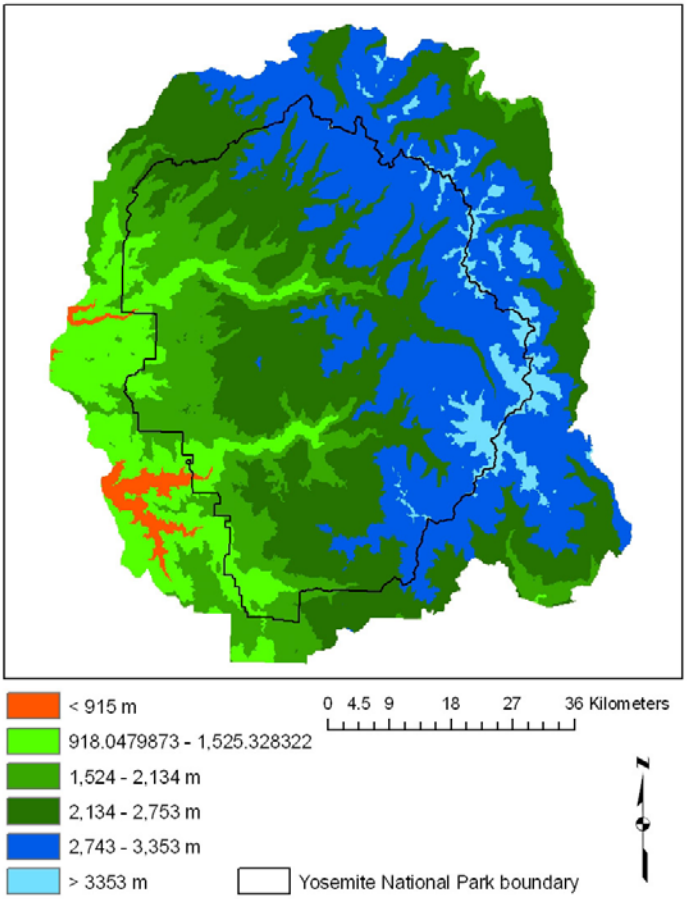


Figure B-1. The elevation grid for the entire environs was classified into ecological zones according to elevation and location east or west of the crest of the range. The study area is approximately 90 km from north to south and 80 km from east to west. Areas NE, E, and SE of Yosemite are on the eastern slope of the range.

diversity. Each grid is briefly described below.

Elevation grid. The clipped DEM was reclassified according to the classes established by the ecologists (Figure B-1). The classes were:

| | | |
|---|---|---|
| West slope of the Sierra Nevada < 3,000 feet | <915 m | Gridcode = 1 |
| West slope 3,000–5,000 feet | 915-1524 m | Gridcode = 2 |
| West slope 5,000–7,000 feet | 1524-2134 m | Gridcode = 3 |
| West slope 7,000–9,000 feet | 2134-2743 m | Gridcode = 4 |
| West slope 9,000–11,000 feet | 2743-3353 m | Gridcode = 5 |
| West slope > 11,000 feet | >3353 m | Gridcode = 6 |
| East slope 7,000–9,000 feet | 2134-2743 m | Gridcode = 7 |
| East slope 9,000–11,000 feet | 2743-3353 m | Gridcode = 8 |
| East slope > 11,000 feet | >3353 m | Gridcode = 9 |

Geology grid. The geology data were originally provided as a coverage export file by NPS staff. The staff had attributed the map with the geologic classes the ecologists felt were important to vegetative diversity (Figure B-2). The classes were

| | |
|---|---|
| Plutonic | Gridcode = 10 |
| Alluvium | Gridcode = 20 |
| Morainal | Gridcode = 30 |
| Metamorphic | Gridcode = 40 |
| Volcanic | Gridcode = 50 |

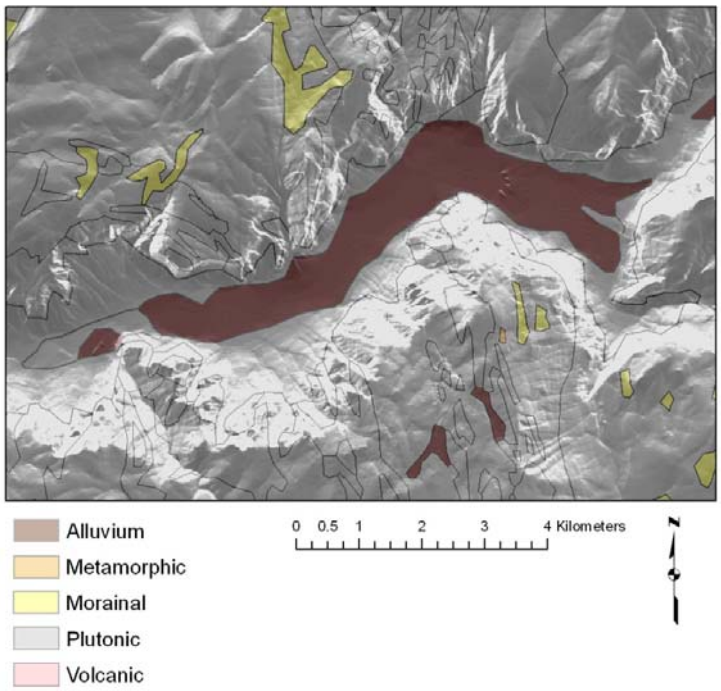


Figure B-2. This clip from the geology coverage shows granitic (in gray) rock surrounding the alluvium (in brown) of the floor of Yosemite Valley. The yellow areas are moraines.

Aspect grid. Again using the clipped DEM, aspect was calculated (Figure B-3). The output of this process gives a value from 1–360 degrees, representing the compass bearing each cell faces. This grid was reclassified into five classes:

| | |
|---|---|
| None (flat) | Gridcode = 100 |
| Northeast | Gridcode = 200 (0–90º) |
| Southeast | Gridcode = 300 (91–180°) |
| Southwest | Gridcode = 400 (181–270°) |
| Northwest | Gridcode = 500 (271–359°) |

Slope grid. The DEM was used to calculate slope in degrees. The 1997 BPU analysis grouped the slopes into three classes, and hydrology was treated as a separate grid. Prior to the 1998 field season, it was noted that riparian corridors were finely grained with individual cells of unique BPUs. The ecologists felt the riparian areas had been overstratified, and ways were discussed to adjust the BPUs to be a more accurate ecological model. Hydrology was redefined as an attribute of the slope. Slopes of 0 degrees adjacent to permanent water bodies were considered hydric, as were buffers of one cell surrounding water courses on slopes to 35 degrees.

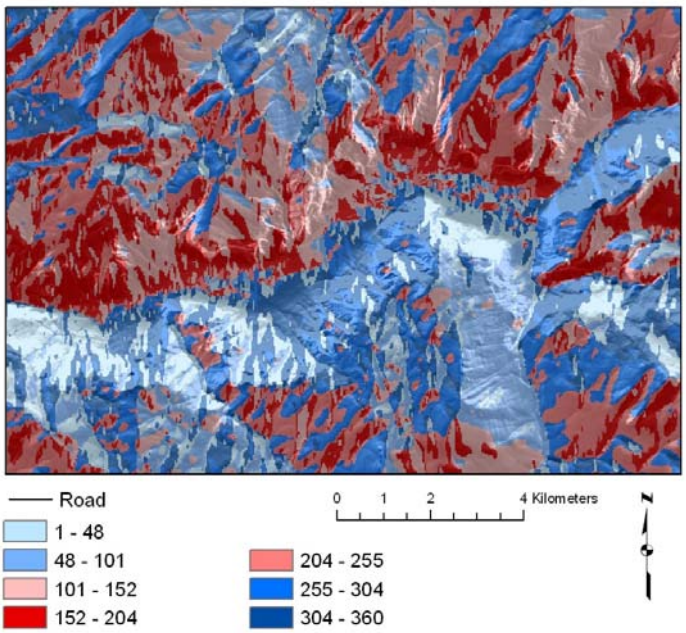


Figure B-3. This subset of the aspect coverage depicts cooler slopes (north facing) in shades of blue, warmer (south facing) in red in the vicinity of Yosemite Valley. Completely flat areas are shaded green.

The final classes were

| | |
|---|---|
| 0–3° Hydric | Gridcode = 1,000 |
| 0–3° Nonhydric | Gridcode = 2,000 |
| 3–35°Hydric | Gridcode = 3,000 |
| 3–35° Nonhydric | Gridcode = 4,000 |
| > 35° | Gridcode = 5,000 |

Access considerations and use of a cost surface. We took two approaches to addressing the efficiency and safety of accessing field sampling areas. Prior to the 1998 field season, actual site selection began using the BPUs generated by the combination of these four grids. An initial attempt was made to use the results of a neighborhood analysis (ESRI, Redlands, CA) to select sites with a relatively diverse assemblage of BPUs within a one-mile radius. Comparing the results of this selection against USGS topographic maps revealed that proximity was not analogous with access. The slope, aspect, and elevation components of the biophysical analysis virtually assured that variability within a small area corresponded with topographic extremes (Figure B-4). Selection of sample sites based solely on this neighborhood analysis would have exposed the field crews to hazardous travel conditions.

We then developed a second approach using a terrain model of the park and environs to derive a cost surface. The cost surface reflects the relative cost of accessing areas in terms of difficulty and safety. Grid cells close to roads and trails are attributed with low values or “costs.” The DEM of the environs was utilized to calculate slope in degrees. An analysis mask was constructed by combining the arcs of all known roads, trails, and streams. Converting these arcs to a grid and reclassifying them as "No Data" values allowed the removal of cells containing roads, trails, and permanent water bodies from the slope grid. The resulting grid was again

reclassified so all cells with the value of "No Data" (corresponding to the eventual locations of all roads, trails, and permanent water bodies) were changed to a value of "0." Cells with slopes of

greater than 45 degrees were also changed to "0." The trails grid was classified so each trail cell had a value of "2," while nontrail cells had a value of "0." Using map algebra, the reclassified trail and slope grids were added together. The road grid was reclassified so each road cell had a value of "1," while nonroad cells had a value of "0." Map algebra was again used to subtract the reclassified road grid from the slope/trail grid. The resultant grid now contained values of "-1" for roads, "0" for streams and lakes, "1" for cells where a road crossed a trail, and "2" for trails.

Figure B-4. This image of the Yosemite Valley shows the final Biophysical Units (BPUs). Each unique combination of slope, aspect, elevation, geology, hydrology, and fire history forms a polygon. Only 20 colors are used in this picture for ease of visual interpretation. There are approximately 75 BPU types within this area.

This grid was reclassified once more to convert "-1" cells to a value of "1" and cells valued at "0" to "No Data." This final cost surface values permanent water courses/bodies and dangerously steep slopes as "No Data" which is considered a barrier in subsequent path/cost analysis. All paved roads have a value of "1," and unpaved roads and trails have a value of "2." Bridges over streams are correctly valued "1" or "2," and all other cells are reclassified according to their slope, varying from "3" for flat to "45" for very steep slopes. Using this cost surface in a weighted-distance function with paved roads as the "source," each cell within the environs is assigned to the least accumulative cost path to the least costly source.

A weighted-distance function was then used to help determine plot placement for the 1998 field sampling season. Centroids were determined for each BPU larger than the minimum mapping unit (0.5 hectare). Centroids that fell outside the boundary of their parent polygon were projected back within the polygon. The cost was then calculated for travel from each centroid back along its least-cost path to the nearest road. Spatially joining the output of this calculation with the original BPU grid provided a table listing the cost associated with visiting any BPU. Ordering this table by BPU value, three polygons of each type with a low to moderate travel cost and divergent *x,y* coordinates were chosen. This subset of BPUs represented an accessible selection of each type dispersed over its range of distribution. Clustering of samples was not an overt selection criterion, but examination of the final spatial data set revealed that clustering had occurred with enough regularity to allow efficient sampling within any given geographic region.

Adjustments to the Gradsect Approach for 1999 Sampling. Approximately 1,500 aerial photographs were required to cover the park and environs. There was insufficient time to complete photointerpretation of the entire set before the end of the 1999 field season. To most

effectively sample vegetation that season, ecological sampling focused on unsampled BPUs that presented undefined signatures to the photointerpreters and those that corresponded to types needing additional samples for the classification.

The park and environs had been divided into eight ecological zones (see Introduction). Each ecological zone contained a relatively exclusive subset of vegetation types. The polygons of the cost surface coverage were spatially joined to each ecological zone subset of unsampled BPUs. Approximately three polygons of every BPU type were then selected based on travel costs and divergent x,y coordinates. A set of 30–50 photos were interpreted for each ecological zone based on the distribution of the selected BPUs. Two months before the sampling season, photointerpreters began interpreting the first ecological zone. Photointerpretation was scheduled to precede the field crews' work in each ecological zone so they would have photos with delineated polygons to direct their sampling. The oak-chaparral ecological zone (Zone I) was first, followed by the California red fir ecological zone (Zone III). Work then focused on the lower east slope and the pinyon-sage ecological zone (Zone VIII). Interpretation progressed steadily upslope as dictated by anticipated weather and plant phenology. The photointerpreters used previously collected plots from the ecological zone and their own field visits with ecologists to train them to recognize distinct vegetation signatures. Unrecognizable signatures and types known to need additional samples for classification were targets of the field crews.

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# Appendix C: Vegetation Classification Development

## Methodological Details

Development of the final vegetation classification for Yosemite National Park and environs involved classification of ecological plot data into natural groupings, definition of membership rules for each association and alliance based on species constancy and cover values, and application of decision rules to assign vegetation names to all existing data. In developing the classification, data sets were weighted differently depending on their representativeness of the range of biophysical environments across the entire mapping area and on their completeness in terms of species composition.

The PC-Ord software suite of ordination and classification tools (McCune and Mefford 1997) was used to analyze the 1998–1999 plot data. The classification analysis for all sampling data followed a standard process. First, all sample-by-species information was subjected to two basic TWINSPAN runs. The first was based on presence/absence of species with no abundance data considered. This provided a general impression of the relationships among all the groups based solely on species membership. The second was based on the standard default run where cover values are converted to the following five different classes:

| | |
|---|---|
| Class I | merely present–2% |
| Class II | > 2–5% |
| Class III | > 5–10% |
| Class IV | > 10–20% |
| Class V | > 20% cover |

These cover values are reasonable for most vegetation. The first three cover classes compose the majority of the species values. This second run demonstrated the modifications that cover values can make on the group memberships. Depending on the size of the data set, the default runs were modified to show from six to 12 divisions (the largest data sets were subdivided more than the smaller data sets). A minimum group size of three was specified for all runs. The intent was to display the natural divisions at the finest level of classification (the association) rather than the alliance level.

Following each of these runs, consistent groupings were identified and compared. Following the identification of natural groups in TWINSPAN, cluster analysis using Ward's scaling method and Euclidean Distance (McCune and Mefford 1997) measure was employed for an agglomerative view of grouping as opposed to the divisive grouping in the TWINSPAN algorithm. The congruence of groupings between TWINSPAN and cluster analysis was generally close. Disparities were resolved by reviewing the species composition of individual samples. Most of these uncertain plots either represented transitional forms of vegetation that could be thought of as borderline misclassified plots or outliers with no similar samples in the data set.

Because of the size of the data set, initial TWINSPAN runs were made to help break the data into finer levels that were, in turn, reanalyzed using TWINSPAN and cluster analysis. This process is known as progressive fragmentation (Bridgewater 1989). The full data set was first analyzed together, then broken into distinct subsets and individually analyzed. Subsets included

riparian shrub and tree-dominated plots, upland herbaceous plots, shrub-dominated plots, and nonriparian tree-dominated plots.

Following cluster analysis and TWINSPAN analysis of all subsets of the primary new data set, each plot was revisited within the context of the cluster to which it had been assigned to quantitatively define the membership rules for each alliance. These membership rules were defined by species constancy and species cover values and were translated into a first-order plot-based classification.

The first-order classification was tested in the field during field visits in 1999–2001 and was refined into the key presented in this report.

The set of new ecological plot data collected throughout the mapping area in 1998-1999 was to be used as the principal means of defining the association composition throughout the mapping area. As a result, careful scrutiny of the membership of each grouping defined had to be employed to establish membership rules for all existing plot data and set the standard for the definition of the associations defined as one of the products of this project.

In general the classification process followed these steps:

- Ran outlier analysis on data, including subsets, to determine most distantly related plots.
- Ran presence–absence TWINSPAN to determine general arrangement of species along the gradient of axis 1 of DCA (both Reciprocal Averaging techniques of species-by-sample scores).
- Ran different permutations of TWINSPAN to see the general variation in arrangement of samples. Samples generally held together well and main gradient did not vary.
- Selected the final representative TWINSPAN run to use in the preliminary labeling.
- Determined the preliminary alliance and association label for each of the samples.
- Identified major break points (main divisions) in TWINSPAN of full data set and subjected major subsets of data to individual TWINSPAN runs.
- Ran cluster analysis (Ward's method) to test congruence with the subset TWINSPAN groupings.
- Developed decision rules for each association and alliance based on conservative group membership possibilities based on review of species cover on a plot-by-plot basis.
- Used decision rules developed in the new data to assign vegetation names to all existing data.

#### *Treatment of Outliers*

Although outlier plots (plots that did not fit neatly into analysis groupings) have a strong influence on the arrangement of the main body of vegetation data, we decided not to remove them from the analysis. Although outliers were typically removed for additional analysis to clarify the main groupings of samples, they were considered as valid samples in the final enumeration and description of types. Because the sampling scheme tended to underrepresent the

rare types, based on their rare biophysical environments, these relatively unique samples were considered important. They were often the only representatives of rare alliances defined from areas beyond the boundary of the study. In some cases they represented unusual species groupings heretofore undescribed and were viewed as affording perspective into unusual vegetation types that would deserve further sampling at some future date. These vegetation plots are also mentioned in the key and classification to alert users of the classification to their potential existence.

### *Ancillary Data Sets*

Analysis of the 754 Wieslander plots, the 362 NRI plots, and the 169 Potter (USFS) plots followed a similar process to the one outlined above. Because each of these data sets used different sampling methodologies and assumptions, none of these sets was combined with others. Instead, we analyzed each separately. Following individual analysis of the data sets, we compared the natural groupings among the four data sets to look for congruence. For most types with full species data (all except Wieslander), there was generally no problem identifying the relationships among the data sets and assigning each plot to a unit in the refined classification based on the 604 plots collected in 1998–1999 using the gradsect sample allocation design.

For developing the final classification, the 1998–1999 field data were weighted most heavily because they represented the best full-scale distribution of samples across the full spectrum of the environ's biophysical environments. The NRI data were weighted second in importance because they also represented a fairly detailed perspective of samples throughout the park and contained information on all species. Potter data were weighted next in importance in spite of full representation of species because they were only representative of a portion of the vegetation of the mapping area. The Wieslander data set was weighted lowest in importance as it did not contain full species data for each plot and was skewed toward wooded vegetation. It must be noted that any vegetation types that are defined primarily through the analysis of the Wieslander data should be considered as somewhat generalized. Allen *et al.*, 1991 have described the classification units defined from the analysis of Wieslander plots as "subseries." In the USNVC terminology this would be translated as a level between alliance and association or informally, "suballiance." Most of the classification units defined by Wieslander data are wooded vegetation types in the subalpine zone including the Sierra lodgepole pine (*Pinus contorta* var. *murrayana*) alliance, the whitebark pine (*Pinus albicaulis*) alliance, and the mountain hemlock (*Tsuga mertensiana*) alliance. Thus, it may be expected that further plot data will be required to clarify association-level differences in these types within the study area.

The classification presented here is based on the standard hierarchy of the U.S. National Vegetation Classification (Grossman et al., 1998) as supported by NatureServe (see www.natureserve.org). A conservative approach was taken to the formation and other upper levels of the classification in keeping with current revisions of the national hierarchy. That is, a modal formation for an alliance was selected rather than developing multiple formations and alliances for groups such as hydrologic variations or variations in canopy density, which may force an otherwise ecologically homogeneous alliance into multiple alliances or formations. For example, Sierra lodgepole pine associations were placed under a single alliance rather than into separate forest and woodland alliances based on canopy density. Associations were considered reasonably well established if they were represented by five or more samples. Types with fewer than three samples were not considered bona fide associations and thus were not described in the

report but were mentioned in the classification list as a possible impetus to search for further examples of them. We were conservative about type names and retained original author's name for a type even if it did not follow alliance name order (e.g., *Abies concolor-Pinus lambertiana-Abies magnifica* Forest of Potter (1998) in the *Abies magnifica-Abies concolor* Alliance).

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# Appendix D: Natural Resource Inventory Plot Data Protocol

Vegetation Inventory and Type Mapping Project, Yosemite National Park
**Protocol for Field Plot Data Files**

The following data tables store vegetation and environmental data associated with ecological field plot data collected in Yosemite National Park between 1988 and 1993 as ground verification of classified Thematic Mapper imagery. The field PLOTNO is common to all of the tables to provide for linking observations within plots among tables. Each relevant table is listed below along with its field names, field types, original field sizes, field definitions, and notes regarding acceptable values.

**VEGPLOT.DBF**
This table contains general, descriptive, and location information for NRI field plots.

| Field | Type | Width | Comments |
|---|---|---|---|
| PLOTNO | Character | 9/5 | Arbitrarily assigned consecutive numbers. |
| PLOTMARKER | Logical | 1 | Signifies whether a marker was left on the plot. Leave empty if missing |
| DATE | Date | 8 | Date of data collection |
| PHOTOROLL | Numeric | 2 | Film roll number on which plot photographs are taken |
| PHOTOEXP | Character | 15 | Plot photograph exposure numbers divided by slashes (e.g., 24/25/26/27) |
| AER_PHOTO | Numeric | 4 | Number of aerial photograph that includes plot location (9999 = Missing data) |
| QUAD | Character | 6 | Topographic quadrangle (7.5- or 15-minute series) on which plot is located. Where both are referred to, the 7.5-minute series name will be recorded. Six-character codes are listed in TOPO.DBF. |
| UTME | Numeric | 6 | Plot location east (x) coordinate in Universal Transverse Mercator projection to the nearest 0.1 kilometer (from map for 1988-1990) or 0.001 kilometer (from global positioning device for 1991-1993), UTM Zone 11, NAD1927 datum |
| UTMN | Numeric | 7 | Plot location north (y) coordinate in Universal Transverse Mercator projection to the nearest 0.1 kilometer (from map for 1988-1990) or 0.001 kilometer (from global positioning device for 1991-1993), Zone 11, NAD1927 datum |

| Field | Type | Width | Comments |
|---|---|---|---|
| DECL | Numeric | 4.1 | Compass declination used in locating plot. 1989 decl. = 18.0; 99.9 = Missing; June 1990 decl. = 18.0; After July 1, 1990 plots in 1990 decl. = 16.5; 1991–1993 decl. = 16.5 |
| ELEV | Numeric | 5 | Elevation recorded in feet. |
| ASPECT | Numeric | 3 | Recorded in degrees; 0 = flat |
| SLOPE | Numeric | 2 | Recorded in degrees; 0 = flat |
| TEAM | Character | 30 | List of personnel on plot recorded in four-letter codes (see OBSVRS.DBF) with codes divided by slashes |
| LOCATION | Character | 30 | Brief description of plot location |
| DESCR | Memo | 10 | Plot description including dominant species, topography, unique features, and relocation notes |
| FIRE | Character | 20 | Brief description of fire evidence in 17.8-meter radius plot. |
| DISTURB | Character | 40 | Brief description of disturbance on plot |
| H2O | Numeric | 2 | Amount of 17.8-meter radius plot covered by water, recorded in square meters; 999 = Missing |
| H2OTYPE | Numeric | 1 | 1 = Standing water; 2 = Flowing water; 0 = None; 9 = Missing |
| ROCKCLASS | Numeric | 1 | Amount of 17.8-meter radius plot covered by rock recorded in cover classes; 9 = Missing |
| ROCKAREA | Numeric | 3 | Amount of 17.8-meter radius plot covered by rock, recorded in percent; 999 = Missing; used after 1990 |

## PLOTTYPE.DBF table

This table lists vegetation types occurring within plot from the state wide Holland (1986) classification.

| Field | Type | Width | Comments |
|---|---|---|---|
| PLOTNO | Text | 9 | Plot number |
| TYPECODE | Text | 5 | Vegetation type code present within plot from VEGTYPES table, a listing of types and their codes ; 99999 = Missing. |

Total: 2 fields

**ALL SPECIES COVER table**

| Field | Type | Width | Comments |
|---|---|---|---|
| PLOTNO | Character | 9 | Plot number |
| JCODE | Character | 6 | Code from JFLORA.DBF for plant species indicated in SCINAME |
| SCINAME | Text | 115 | Scientific name of taxon in Hickman (1993) nomenclature |
| COVERCLASS | Numeric | 1 | Cover class by species based on mean cover in COVER field; 1 = <5%, 2 = >5-25%, 3 = >25% |
| COVER | Numeric | 3 | Mean cover (%) of the species or material indicated in JCODE and SCINAME |

**TOPO table**

This field contains six-character codes for all USGS topographic quadrangles in Yosemite.

| Field | Type | Width | Comments |
|---|---|---|---|
| QUAD | Character | 6 | 6-character code for USGS topographic quadrangle using<br>-first 4 letters of single-word map names<br>-first 2 letters of each word for 2-word map names<br>-for 3-word map names, first letter of first 2 words and 2 letters from third word |
| MAPNAME | Character | 25 | Full map name |
| PUB_DATE | Character | 4 | Year map was published |

**OBSVRS table**

This field contains four-letter codes for personnel involved with field data collection.

| Field | Type | Width | Comments |
|---|---|---|---|
| INIT | Character | 4 | First 2 letters each from first and last name |
| NAME | Character | 30 | Full name of observer |
| YEAR | Character | 19 | Year or years individual has been involved with field data collection |

**SOIL table**

This field contains information on soil depth and soil samples collected from vegetation inventory plots by plot number.

| Field | Type | Width | Comments |
|---|---|---|---|
| PLOTNO | Character | 9 | Plot number |

| | | | |
|---|---|---|---|
| DEPTH1 | Numeric | 2 | Depth of uppermost horizon; in deepest horizon, depth should be considered a minimum estimate as probe length = ~25 centimeters; 99 = Missing horizon depth |
| DEPTH2 | Numeric | 2 | Depth (centimeters) of second horizon from soil surface |
| DEPTH3 | Numeric | 2 | Depth (centimeters) of third horizon from soil surface |
| DEPTH4 | Numeric | 2 | Depth (centimeters) of fourth horizon from soil surface |
| DEPTH5 | Numeric | 2 | Depth (centimeters) of fifth horizon from soil surface |
| MEAN_DEPTH | Numeric | 4 | Mean depth (centimeters) of soil calculated from 10 randomly placed probes in 0.1 ha plot |
| COMMENTS | Character | 100 | Comments on soil or soil sampling |

***Literature Cited***

Hickman, J. (ed.) 1993. The Jepson manual. University of California Press. Berkeley, CA.

Holland, R. F. 1986. Preliminary descriptions of California terrestrial natural communities. Unpublished administrative report. California Department of Fish and Game, Natural Diversity Database, Sacramento, CA.

# Appendix E: 1998–1999 Field Sampling Protocol, Field Form Instructions, and Field Form

A Basic Guide for Field Work

Prepared for the 1999 Field Season, USGS/NPS Vegetation Mapping Program

This document is intended to give you general instructions and guidelines for conducting your fieldwork at Yosemite National Park. Detailed, field-by-field coding conventions for the primary form you will be completing in the field (the Plot Survey form) are provided in the "cheat sheet" at the back, along with an example of a form. A Fuel Inventory form and Accuracy Assessment Point form—other forms you will become very familiar with—are also included at the back for reference.

## OVERVIEW

The data that you collect in Yosemite this year will be used to create a relatively fine scale delineation of vegetation pattern in Yosemite National Park and environs, an area of nearly 1.4 million acres across the east and west slopes of the Sierra Nevada. The range of habitats, and the corresponding diversity of vegetation types, found here is extremely complex. However, only broad-scale vegetation patterns (about 30 vegetation types for the park) have thus far been delineated (Moore, 1993). The understanding of finer-scale, ecologically distinct vegetation types that you will help create may be used by the park to plan appropriate management activities, monitor the results of these activities, track long-term changes in vegetation, direct searches for rare species, model fire behavior, and portray the wealth of natural diversity on park lands to the public.

Establishing a field sampling strategy that captures—in only two field seasons—sufficient data on all the distinct vegetation types in an area as large, diverse, and rugged as Yosemite is an ongoing challenge. To make the sampling as efficient as possible, the key environmental variables thought to be driving vegetation pattern were identified. These included factors such as slope, elevation, aspect, and geology (see NatureServe, 1998). The geographic locations of various classes of these environmental factors were then overlaid, and areas with unique combinations (called biophysical units or BPUs) were mapped. (For example, a west-slope, 5,000–7,000-foot elevation, southwest-facing, 3–35 degree slope with *granitic* geology was identified as a different biophysical unit from a west-slope, 5,000–7,000-foot elevation, southwest-facing 3–35 degree slope with *volcanic* geology.) The basic idea is that unique vegetation types may occur in each of the different habitats represented by the BPUs. Wherever possible, areas with clusters of these different BPUs in close proximity to each other *and* in close proximity to roads and trails were located, so that getting to these places to sample could be as easy as possible.

In the next (ongoing) step, photointerpreters will examine aerial photos of the areas identified by the (as yet unsampled) BPUs and make an educated guess about what type(s) of vegetation will be found there. These "guesses" are based on intensive field reconnaissance of all major ecological zones in the park and environs. We are fortunate in having interpreters who have extensive field experience and who have repeatedly taken the time to ground-truth their interpretations. The vegetation "types" they are choosing from when they tag their polygons are

those included in the preliminary classification of park vegetation created using the U.S. National Vegetation Classification system (Grossman et al., 1998). The finest possible level of this classification system (the association level) is used wherever possible. The alliance, or a synthetic mapping unit that depicts the ecological setting of an otherwise unmappable vegetation type (for example, photodiscernable wetland hydrologic categories that may contain up to several small plant associations), is used if necessary.

The photointerpreters will attempt to select 15 polygons per association or alliance. Polygons are selected for their "representativeness" to the association or mapping unit. In addition, they are selected for accessibility in the field. The photointerpreters will give the selected, delineated polygons labeled with U.S. National Vegetation Classification types to the field coordinator, who will be keeping a running tally of the number of plots that still need to be established and sampled for each type.

The field coordinator will give you and your field partner your assignments based on the tally. You, your partner, and the field coordinator will be evaluating the data you collect in the field, assigning a second (still preliminary) vegetation type, and updating the tally of vegetation types *x* number of plots still needed. This tally will be updated approximately every two weeks during the field season. The goal of this constant feedback and revision is to use *your* time as efficiently as possible—we are trying our best to avoid oversampling of some types and undersampling of others. Deciding where to sample to capture the full range of diversity over the park is going to be very much an iterative process as the field season goes along.

**GETTING THERE**

Once you have been given an "assignment" by your field coordinator, what you will actually have in hand is a photo print with a clear Mylar overlay marked with a dot indicating the representative core of the polygon. The coordinates for center of a polygon that the photointerpreters believe is all one distinct vegetation type. (The size of the polygon itself will, of course, vary depending on the extensiveness the vegetation type.) You and your partner will be navigating toward that polygon centroid using your road and trail maps and/or GPS, along with guidance from your field coordinator. The Mylar overlays may have roads and trails highlighted to help you as well. (You will be concentrating on "zones" of the park in sequence, so you will not have to traipse all over the park to do your fieldwork.)

The Mylar overlays will also be labeled with the following alphabetic key:
a = A polygon of a vegetation type that is confidently mappable from the aerial photography and requires a total of three plots to support the classification/description of the type. The collection of field samples for these types is a high priority for both the classification and mapping efforts.
b = A polygon that is probably not mappable from the aerial photography. The photointerpretation signature for such polygons is not expected to be clear due to the regularly small size of vegetation stands (below the minimum mapping unit), and/or complex interdigitation with other associations that have similar photo signatures. The priority for sampling these types is high for classification but less important overall than the "a types." Vegetation complexes and other environmental descriptors will be developed to provide polygon attributes for these types as they are encountered.

c = Not used. These will not be indicated on the Mylar because all "c type" polygons are adequately sampled throughout the project area.
d = A polygon that cannot be interpreted by the photointerpreters as any of the existing vegetation types in the working classification yet appears to represent a "new type" that recurs across the landscape within a given ecological zone. The collection of adequate plots in these types is a high priority. You will visit a subset of these polygons to determine whether: (1) this is a variant of an existing type or a mosaic of existing vegetation types or (2) this may represent a new vegetation type. If the former is true, then you will make a brief note using the observation point (accuracy assessment) form provided. If the latter is true, then you will take a full plot (until a total of three are taken for this new type).
e = A polygon that photointerpreters have trouble identifying but does not appear to recur across the landscape. These represent isolated "question marks" from the photointerpreters. Observation Point forms should be filled out whenever these are encountered. However, these polygons are assumed to be of lower priority than the "d" polygons.
The order of priority for sampling is therefore: A, D, B, E, and C.
Note: Numerous selected polygons may also have question marks labeled next to the letter. This denotes some uncertainty as to the type labeled due to a number of factors.

***Before you leave ...*** check that you have all the materials needed to complete your fieldwork. (Please see the checklist and "considerations for mission planning" at the end of this document to help you.)

***Every single morning ...*** check your GPS receiver to make sure it is set to NAD27.

***Along the way ...*** look around. Digital data layers are great, but they do ***not*** replace human perception. If, on the way to one vegetation type, you see an assemblage of plants that seems unique and that you think is not included on the list of vegetation types to be sampled, use your radio to contact the field coordinator. If you will be working with another team and may potentially overlap with vegetation types the team is sampling on a given day, be sure to contact the team using your radio and discuss what you have found, so that efforts are not duplicated or opportunities missed. You and the field coordinator or the other team may decide to change your plans and sample the vegetation pattern you discovered. Those of you who were part of last year's field effort are in an especially good position to help us "catch" vegetation types that may otherwise be missed. In many ways, this could be your most important contribution to the project.

## ONCE THERE

### *Establishing a Plot*

1) Figure out where to place your plot. This is a subjective process. You will want to place your plots in areas that seem to be both relatively **homogeneous** and **representative** of the vegetation of the polygon as a whole. In other words, avoid areas where the vegetation appears to be transitioning from one type to another and areas with anomalous or heterogeneous structure or species composition. Take some time to do this carefully because the plots you set up will be *permanent*—relocated and resampled over time to determine responses to management and other useful things. Look at *all* the vegetation strata to determine if the area is structurally and floristically uniform, and generally try to place your plots at least 30 meters from what you see as

the "boundary" between this vegetation type and any neighboring, distinctly different types. During the training period, this step will be emphasized and discussed in detail. However, the rule of thumb is to conduct a reconnaissance of the plot if time and topography allow. If not, rely on the air photointerpreter "center dot" as a guide to where you should place your plot.

***Note***: In cases where a polygon is very heterogeneous, more than one plot may be needed. Again, look around, use that human perception, and contact your field coordinator via radio if you need guidance about whether or not to establish more than one plot.

2) Drive a piece of rebar into the ground with a rock or hammer. This will be the **SOUTHEAST** corner of your plot.

3) Using your GPS receiver, record the UTM of this corner of the plot under the **Field UTM X** and **Field UTM Y** on the field form. Remember that this is about to become a permanent plot, so being able to *find* it again will be key—use the GPS rather than estimating! (If you cannot get a GPS reading, estimate the coordinates from the topographic map and note on the form that you had to resort to this method.)

4) Stand at the rebar with your compass and direct your partner, who has the tape measure, to measure plot boundaries to the north and west (do not forget to correct for magnetic declination). Leave the tapes down as borders while working. Mark only the one corner with rebar. Standard plot sizes should be as follows:

| **If you are in a ...** | **You should usually make your plot ...** | **Giving you a plot area of ...** |
|---|---|---|
| **Forest** (trees have their crowns overlapping, usually forming 60–100% cover) | 20 m x 50 m | 1,000 $m^2$ |
| **Woodland** (open stands of trees with crowns usually not touching. Canopy tree cover is 25–60% OR exceeds shrub, dwarf-shrub, herb, and nonvascular cover) | 20 m x 50 m | 1,000 $m^2$ |
| **Shrubland** (shrubs greater than 0.5 meter tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover) | 20 m x 20 m | 400 $m^2$ |
| **Dwarf-shrubland** (heath) (shrubs less than 0.5 meter tall are dominant, usually forming more than 25% cover OR exceeding tree, shrub, herb, and nonvascular cover) | 20 m x 20 m | 400 $m^2$ |
| **Herbaceous** (herbs dominant, usually forming more than 25% cover OR exceeding tree, shrub, dwarf-shrub, and nonvascular cover) | 10 m x 10 m | 100 $m^2$ |
| **Nonvascular** (nonvascular cover dominant, usually forming more than 25% cover) (not being used in Yosemite) | 5 m x 5 m | 25 $m^2$ |

***Note:*** You can deviate from the standard plot *shapes* where that makes sense, but the total plot *area* encompassed by the boundaries should be as listed above for each major class of vegetation. For example, forested riparian vegetation may be sampled in a more linear 10 x 100 meter (1000 $m^2$) plot; herbaceous riparian or ridgeline vegetation in a 2 x 50 meter (100 $m^2$) plot.

5) Once the plot is established, it is generally a good time to fill out the **Identifiers/Locators** part of your Plot Survey form (see the cheat sheet) and take the plot photos.

## DATA COLLECTION

### Environmental Description

See the coding instructions at the end of this document for guidance on the specific fields.

### Vegetation Description

For guidance on the specific fields on the second page of the form, see the coding instructions.

As you begin to collect the species, DBH, and cover information on page three, keep these four rules in mind—they will speed your data collection considerably.

1) If there are more than 25 trees over 10 centimeters DBH, measure a representative quarter of the plot (this may be any portion of the plot but should be 25 percent of the total plot area). CLEARLY NOTE on the form where this subsample was taken. Also, remember that DBH is an inherently inexact measurement (your breast height may be very different from the next ecologist's for one thing), so do not fret over this one—this should be a quick measurement!

2) Except in very diverse plots, do not spend more than **20 minutes** looking for new and different species to record. Remember that these plot data are to be used to classify the overall vegetation of the Park, not to make a complete species list for it. And if you had to spend much more than 20 minutes to *find* a species, it is probably not going to be important in characterizing the vegetation type. Based on field experience last year the most diverse plots were lower-elevation westside oak woodland and grassland plots. For these and other similarly diverse plots with over 25 taxa you may take up to 30 minutes on the listing process.

3) We have asked you to estimate in cover classes, but often it is helpful to make and attempt to estimate an actual percent cover for certain species. This may be useful in getting a sense of total vegetation cover (by adding percentages) and in determining to which category a species that is a borderline between two cover classes should be assigned. Try not to agonize over the percent cover column. This is only a rough visual estimate.

4) If you cannot identify a plant to species, record the species on your form as "unknown species 1," "unknown species 2," "Carex unknown sp. 1," and so forth. Record cover class and other data for the unknown as you would for any other species. Then do one of two things.

If you need the species identified immediately because it appears to be dominant or diagnostic (you are seeing it all over the place or you are seeing much more in this particular vegetation type than in others), take a sample of the species with as much of the plant as possible, especially intact reproductive parts, if present. Place the sample in a baggie, and label the baggie with the plot code and the name you gave it on the data form.

If you do not need the plant keyed immediately, press it. Mark the pressed specimen with the plot code and the name you gave it on the data form.

Give all your specimens, bagged and pressed, to the field coordinator for keying. You can, of course, key some of these yourself, but do not let plant keying get in the way of your primary responsibility—*field data collection*. No one expects you to identify every plant; that is why keying is considered part of the field coordinator's routine responsibilities. (Besides, he/she knows the flora pretty well and may be able to identify the specimen easily.) A quick prioritization of what to key and what to press may be made based on the recurrence of the species in samples and on the cover class estimate of the species in a particular plot. If the species has a high cover value (> 1%), it is more of a priority to identify. Field crews should mark the specimen tag with its cover class estimate as well as its unique identifying number for the vegetation sample.

A sample Plot Survey form is provided at the end of this document.

**Accuracy Assessment Point Form**

Occasionally, you will need to collect some plot-free data. This will happen when

1) The photointerpreters cannot tell what kind of vegetation is in a particular polygon ("d" or "e" on the Mylar) *or*
2) The photointerpreters were wrong about what kind of vegetation is in a polygon *and* sufficient plot data have already been collected for the kind of vegetation that is actually there. (Check with your field coordinator via radio if you think this is the case.)

In these two cases, there is no need to establish a plot. However, you will help the photointerpreters identify this type in the future if you collect some data. You will navigate to the GPS centroid for the polygon as usual, scout out the polygon briefly to get a feel for what it is like, and record some general data to characterize it on an Accuracy Assessment Point form. This is an abbreviated version of the Plot Survey form, and the same cheat sheet can be used to help with filling it out. GPS points may be taken at any part of the polygon as long as it is greater than 30 meters from its edge, to verify its location.

*We hope you find your field season at Yosemite enjoyable and rewarding. Best of luck!*

## Appendix E (continued)

**Instructions for filling out fields in the Plot Survey Form (YOSE version, 18 May 1999)**

### *Plot Code*
Code indicating the specific plot within the vegetation polygon. For the 1999 field season, the codes will be "YOSE.XXX". To prevent possible duplication of codes, at the beginning of the field season one lead ecologist will take numbers 300–499 and the other will take 500–699. Each lead ecologist will use these numbers to sequentially number plots throughout the field season.

**BPU Code**
The biophysical unit identified will be provided by your field coordinator. This is a less important field this year and can be filled in based on a postprocessing of GIS data from the GIS analysts (Mike Schindel and/or Joe Meyer).

### *Provisional Community Name*
Using the provisional classification of the park with which you have been provided, assign the name of the vegetation type that most closely resembles this type. Enter the finest level of the classification possible. What you put here may or may not agree with the photointerpretation. In fact, *none* of the names may be a good fit; you may have found a new type. The field coordinator will review the "provisional community name" in light of the data you collect and his/her knowledge of the park vegetation and of the classification. The provisional community name that he/she assigns will be used to update the types *x* number of plots needed tally.

### *State*
CA

### *Park Name*
YOSEMITE NP

### *Park Site Name*
Provisional name assigned by fieldworker that describes where the data were collected. It should represent an identifiable feature on a topographic map.

### *Quad Name*
Appropriate name/scale from survey map used; use 7.5-minute quadrangle if possible.

### *Quad Code*
Code of quadrangle map.

### *Field UTM X*
Use GPS; do not estimate. If you cannot get a GPS reading, estimate coordinates from a topographic map and note on the form that this method was used. Note for this and following field: All field crews have been trained in using a UTM grid and a topographic map to estimate within 20 meters of their actual UTM coordinates.

**Field UTM Y**
Use GPS; do not estimate. If you cannot get a GPS reading, estimate coordinates from a topographic map and note on the form that this method was used.

### *Survey Date*
Date the survey was taken—year, month, day.

### *Surveyors*
Names of surveyors, with principal surveyor (usually the lead ecologist) listed first.

### *Directions to Plot*
Precise directions to the site using a landmark (e.g., a named point on the topographic map, a major highway, using park naming conventions for roads) readily locatable on a 7.5-minute topographic map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances as closely as possible to 0.1 mile and use compass directions. Give additional directions to the plot within the site. Do not take more than a couple of minutes to fill this out.

### *Plot Length and Plot Width*
Enter width and length dimensions for square or rectangular plots (or diameter for circular plots). Choose the appropriate plot size based on the following:

| Vegetation Class | Standard Plot Dimensions | PLOT AREA |
|---|---|---|
| Forest | 20 m x 50 m, or 17.8 m radius | **1,000 $m^2$** |
| Woodland | 20 m x 50 m, or 17.8 m radius | **1,000 $m^2$** |
| Shrubland | 20 m x 20 m, or 11.3 m radius | **400 $m^2$** |
| Dwarf-Shrubland (heath) | 20 m x 20 m, or 11.3 m radius | **400 $m^2$** |
| Herbaceous | 10 m x 10 m, or 5.65 m radius | **100 $m^2$** |
| Nonvascular (not used in YOSE) | 5 m x 5 m | **25 $m^2$** |

### *Plot Photos/Roll Number/Frame Numbers*
Indicate (Y or N) if photos of the plot have been taken at the time of sampling and the roll and frame numbers of any photos. (Note: At least 2 photos should always be taken with the black-and-white camera for each plot.)

### *Plot Permanent*
Check off that the plot has been permanently marked. All plots within the national park are "permanently marked" with the rebar. All nonwilderness plots on Forest Service Lands in the environs should also be marked.

### *Plot Representativeness*
Does this plot represent the full variability of the polygon? If not, were additional plots taken? Note additional species not seen in plot in the space provided below. Note: We distinguish in this section from the plot's ability to represent the stand or polygon you are sampling as one component and the ability of this sample to represent the range of variability of the association in

the environs. The former comment may be ascertained by reconnaissance of the stand. The latter comment comes only after some familiarity with the vegetation type throughout the mapping area and may be left blank if you have no opinion at this time.

ENVIRONMENTAL DESCRIPTION

### *Elevation*

Elevation of the plot. **Specify whether in feet or meters** (this will depend on the units used on the GPS or on the topographic map being used). In general, we have determined that the reading you get from a topographic map, provided you are certain where you are, is more accurate than the average reading from the GPS unit. Thus, please attempt to estimate your elevation with the topographic map.

### *Slope*

Measure the slope in degrees using a clinometer.

### *Aspect*

Measure the slope aspect using a compass. Note: All compasses have been preset to an average declination for the park and thus, readings from the Suunto compasses carried by the field crews may be directly noted.

### *Topographic Position*

Topographic position of the plot. Choose one. Below are definitions for categories listed in the Yosemite Code List that follows the field form.

> INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.
>
> HIGH SLOPE (shoulder slope, upper slope, convex creep slope). Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.
>
> HIGH LEVEL (mesa). Level top of a plateau.
>
> MIDSLOPE (transportational midslope, middle slope). Intermediate slope position.
>
> BACKSLOPE (dipslope). Subset of midslopes that are steep and linear and may include cliff segments (fall faces).
>
> STEP IN SLOPE (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.
>
> LOWSLOPE (lower slope, footslope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope and toeslope.
>
> TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

LOW LEVEL (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL WALL (bank). Sloping side of a channel.

CHANNEL BED (narrow valley bottom, gully arroyo). Bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

### *Landform*

Enter the landform that describes the site where the plot was taken. Note that on the Yosemite code list following the field form the landform choices are listed as being either macro, meso, or micro in scale. Thus, select one from each of these landscape scales for any plot (e.g., mountain could be macro, and cirque headwall could be meso).

### *Surficial Geology*

Note the geologic substrate influencing the plant community (bedrock or surficial materials). Select from the categories listed in the Yosemite Code List following the field form.

### *Cowardin System*

If the system is a wetland, check off the name of the United States Fish & Wildlife Service (USFWS) system that best describes its hydrology and landform. Indicate "upland" if the system is not a wetland. Assess the hydrologic regime of the plot using the descriptions below (adapted from Cowardin et al., 1979).

SEMIPERMANENTLY FLOODED - Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's Intermittently Exposed and Semipermanently Flooded modifiers.

SEASONALLY FLOODED - Surface water is present for extended periods during the growing season but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

SATURATED - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's Saturated modifier.

TEMPORARILY FLOODED - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes floodplain wetlands. Equivalent to Cowardin's Temporary modifier.

INTERMITTENTLY FLOODED - Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent on highly localized rainstorms. This modifier was developed for use in the arid west for water regimes of playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and nonwetland situations. Equivalent to Cowardin's Intermittently Flooded modifier.

PERMANENTLY FLOODED - Water covers the land surface at all times of the year in all years. Equivalent to Cowardin's Permanently Flooded.

UNKNOWN - The water regime of the area is not known. The unit is simply described as a nontidal wetland.

### *Environmental Comments*

Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors.

### *Soil Taxon/Description*

This does not apply to the Yosemite Project.

### *Unvegetated Surface*

Estimate the approximate percentage of the *total* surface area covered by each category. Only include categories with over 5 percent cover.

### *Soil Texture*

Using the key below, assess average soil texture.

Simplified Key to Soil Texture (Brewer and McCann, 1982)

A1 Soil does not remain in a ball when squeezed..... sand

A2 Soil remains in a ball when squeezed ..... B

B1 Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you push up over your finger. Soil makes no ribbon ..... loamy sand

B2 Soil makes a ribbon; may be very short ..... C

C1 Ribbon extends less than 1 inch before breaking ..... D

C2 Ribbon extends 1 inch or more before breaking ..... E

D1 Add excess water to small amount of soil. Soil feels at least slightly gritty loam or sandy loam

D2 Soil feels smooth ..... silt loam

E1 Soil makes a ribbon that breaks when 1–2 inches long; cracks if bent into a ring ..... F

E2 Soil makes a ribbon 2 or more inches long; does not crack

when bent into a ring ..... G

F1 Add excess water to small amount of soil; soil feels at least slightly gritty sandy clay loam or clay loam

F2 Soil feels smooth ..... silty clay loam or silt

G1 Add excess water to a small amount of soil; soil feels at least slightly gritty sandy clay or clay

G2 Soil feels smooth ..... silty clay

### *Soil Drainage*

The soil drainage classes are defined in terms of actual moisture content (in excess of field moisture capacity) and the extent of the period during which excess water is present in the plant root zone. We recognize that permeability, level of groundwater, and seepage are factors affecting moisture status. Because these are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. We further recognize that soil profile morphology, for example mottling, normally, but not always, reflects soil moisture status. Although soil morphology may be a valuable field indication of moisture status, it should not be the overriding criterion. Soil drainage classes cannot be based solely on the presence or absence of mottling. Topographic position and vegetation as well as soil morphology are useful field criteria for assessing soil moisture status. Select one category.

RAPIDLY DRAINED - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water addition. Soils are free from any evidence of gleying throughout the profile. Rapidly drained soils are commonly coarse textured or soils on steep slopes.

WELL DRAINED - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 3 feet but may be mottled below this depth. B horizons, if present, are reddish, brownish, or yellowish.

MODERATELY WELL DRAINED - The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are commonly mottled (chroma < 2) in the lower B and C horizons or below a depth of 2 feet. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the solum. In grassland soils the B and C horizons may be only faintly mottled, and the A horizon may be relatively thick and dark.

SOMEWHAT POORLY DRAINED - The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year. Soils are commonly mottled in the B and C horizons; the Ae horizon, if present, may be mottled. The matrix generally has a lower chroma than in the well drained soil on similar parent material.

POORLY DRAINED - The soil moisture in excess of field capacity remains in all horizons for a large part of the year. The soils are usually very strongly gleyed. Except in high-chroma parent material the B, if present, and upper C horizons usually have matrix colors of low chroma. Faint mottling may occur throughout.

VERY POORLY DRAINED - Free water remains at or within 12 inches of the surface most of the year. The soils are usually very strongly gleyed. Subsurface horizons usually

are of low chroma and yellowish to bluish hues. Mottling may be present but at the depth in the profile. Very poorly drained soils usually have a mucky or peaty surface horizon.

VEGETATION DESCRIPTION

**Leaf Phenology**
Select the value that best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10 percent cover.

EVERGREEN - Greater than 75 percent of the total woody cover is never without green foliage.

COLD DECIDUOUS - Greater than 75 percent of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

DROUGHT DECIDUOUS - Greater than 75 percent of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by drought.

MIXED EVERGREEN - COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25–75 percent of the total woody cover. Evergreen and cold deciduous species admixed.

MIXED EVERGREEN - DROUGHT DECIDUOUS - Evergreen and deciduous species generally contribute 25–75 percent of the total woody cover. Evergreen and drought deciduous species admixed.

PERENNIAL - Herbaceous vegetation composed of more than 50 percent perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50 percent annual species.

**Leaf Type**
Select one value that best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10 percent cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

MICROPHYLLOUS - Woody cover primarily microphyllous.

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF HERBACEOUS) - Herbaceous vegetation composed of more than 50 percent broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves.

### *Physiognomic Class*

Choose one.

| | |
|---|---|
| Forest: | Trees with their crowns overlapping (generally forming 60–100 percent cover). |
| Woodland: | Open stands of trees with crowns not usually touching (generally forming 25–60% cover). Canopy tree cover may be less than 25 percent in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively. |
| Shrubland: | Shrubs generally greater than 0.5 meter tall with individuals or clumps overlapping to not touching (generally forming more than 25 percent cover, trees generally less than 25 percent cover). Shrub cover may be less than 25 percent where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation dominated by woody vines is generally treated in this class. |
| Dwarf-Shrubland: | Low-growing shrubs usually under 0.5 meter tall. Individuals or clumps overlapping to not touching (generally forming more than 25 percent cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrub cover may be less than 25 percent where it exceeds tree, shrub, herb, and nonvascular cover, respectively. |
| Herbaceous: | Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25 percent where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively. |
| Nonvascular: | Nonvascular cover (bryophytes, noncrustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25 percent where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively. |
| Sparse Vegetation: | Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%). |

### *Strata/Life-Form, Height, Cover, Diagnostic Species*

Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. Height and cover classes are also listed below.

Trees are defined as single-stemmed woody plants, generally 5 meters in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 meters in height at maturity and under optimal growing conditions.

Note: Because many trees in California are large multiple-stemmed individuals as a result of past fire or other disturbance, the standard definition of a tree as a woody single-stemmed plant 5 meters or more tall has been modified to be any woody plant 5 meters or greater in height. A shrub is a woody plant that typically has multiple stems from the base and is less than 5 meters in height under optimal conditions. Tree seedlings and saplings are identified in the layer in which they occur (e.g., one could have *Pinus ponderosa* as a component of the herb strata, if there were saplings, and also of the T2 layer).

Emergent Tree: Tree strata that averages greater than 10 percent and is significantly taller than the main canopy for the stand.

Tree Canopy: The main tree canopy for the stand over which there may be a scattering of emergent trees and beneath which there may be an understory of subcanopy trees, shrubs, and/or herbs.

Tree Subcanopy: The small trees that may form a distinct layer beneath the canopy and the emergent trees.

Because we are also interested in fuel model development for the vegetation, we are recording measurements on the height to the base of the lowest portion of the crown of representative species in each layer. This is defined as the lowest living branch on the tree or shrub. Thus, an estimate in meters is made between the ground and the lowest juncture of living branches to the trunk. This measurement need only be taken for one representative individual in each height strata.

List the dominant species in each stratum. If species known to be diagnostic of a particular vegetation type are present, list these as well, marking them with an asterisk.

| Cover Scale for Strata | | Height Scale for Strata | |
|---|---|---|---|
| 01 | < 5% | | |
| 02 | 5–15% | 01 | < 0.5 m |
| 03 | 15–25% | 02 | 0.5–1 m |
| 04 | 25–35% | 03 | 1–2 m |
| 05 | 35–45% | 04 | 2–5 m |
| 06 | 45–55% | 05 | 5–10 m |
| 07 | 55–65% | 06 | 10–15 m |
| 08 | 65–75% | 07 | 15–20 m |
| 09 | 75–85% | 08 | 20–35 m |
| 10 | 85–95% | 09 | 35–50 m |
| 11 | 95–100% | 10 | > 50 m |

**Animal Use Evidence**
Comment on any evidence of use of the plot/polygon by nondomestic animals (i.e., tracks, scat, gopher or prairie dog mounds, etc.). Notes on domestic animals should be made in the field below.

**Natural and Anthropogenic Disturbance**
Comment on any evidence of natural or anthropogenic disturbance and specify the source.

### *Other Comments*

Any other comments.

### *Species/DBH/Percent Cover Table*

Starting with the uppermost stratum, list all the species present and cover class (using the scale provided below) and percent cover of each species in that particular stratum. Indicate strata in the left-hand columns. If in the tree layer, note in the "T" column if T1 (emergent tree), T2 (tree canopy), or T3 (tree subcanopy). If in the shrub layer, note in the "S" column if S1 (tall shrub, 2-5 m) or S2 (short shrub, 0.5-2 m). If in the ground layer, note in the "G" column if H (herbaceous), N (nonvascular), V (vine/liana), or E (epiphyte). Tree seedlings are treated in the G column and are indicated by whichever layer name seems most appropriate (e.g., if most seedlings are as tall as the H layer then they are treated as H). Tall shrubs are typically between 2 and 5 meters, short shrubs between 0.5 and 2 m, and dwarf shrubs are less than or equal to 0.5 m. Note that you may list the same species in more than one stratum, based on the maximum height of the individuals. However, those canopy tree-sized individuals should only be listed in the canopy tree category, and those herb-size individuals should only be listed in the H layer.

For plots with trees, list the diameter at breast height (DBH) (in centimeters at 1.37 m up the stem) of all trees above 10 centimeters diameter (this would include each stem from a multistemmed tree). Separate the measurements with a comma. For plots with very high tree density, DBH measurements will be done in a subplot. If the number of trees with a DBH greater than 10 centimeters is more than 25, divide the plot into quarters and measure the DBH of trees in the most representative quadrant. CLEARLY NOTE on the form that this is what you have done.

Cover Scale for Species Percent Cover

| **Code** | **Range of Class** | **Class midpoint** |
|---|---|---|
| 01 | > 0–1% | 0.5% |
| 02 | 1–5% | 3% |
| 03 | 5–25% | 15% |
| 04 | 25–50% | 37.5% |
| 05 | 50–75% | 62.5% |
| 06 | 75–100% | 87.5% |

**Appendix E (continued). NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM (YOSE version, 10 May 1999)**

IDENTIFIERS/LOCATORS

Plot Code____YOSE_____ BPU Code_____

Provisional Community Name_____

State _CA__ Park Name__YOSEMITE NATIONAL PARK_____ Park Site Name_____

Quad Name_____ Quad Code_____

GPS File Name_____ Field UTM X___ ___ ___ ___ ___ ___ m E Field UTM Y___ ___ ___ ___ ___ ___ ___ m N

Error +/- ___ ____ m

Corrected UTM X___ ___ ___ ___ ___ ___ m E Corrected UTM Y___ ___ ___ ___ ___ ___ ___ m N UTM Zone 11

Survey Date_____ Surveyors_____

Directions to Plot

Plot length (m)_____ Plot width (m)____ If circle (diam)____ Plot Photos (y/n) ___ Roll Number _____ Frame Numbers _____
Plot Permanent (y/n) ____ (For location of marker and location and orientation of photos, see other comments.)

Plot representativeness (discuss decisions for placement and/or reasons for nonrepresentativeness)

a. Representativeness of association (if known):

b. Representativeness of plot in stand:

ENVIRONMENTAL DESCRIPTION

Elevation Slope Aspect

Topographic Position (see cheat sheet)

Landform (see cheat sheet)

Surficial Geology (see cheat sheet)

| Cowardian System | Nontidal | | |
|---|---|---|---|
| ___Upland | ___Permanently Flooded | ___Saturated | ____ Unknown |
| ___Riverine | ___Semipermanetly Flooded | ___Seasonally Flooded | |
| ___Palustrine | ___Temporarily Flooded | ___Intermittently Flooded | |
| ___Lacustrine | | | |

| Environmental Comments (dynamic stage, fire history, insect damage, etc.): | Unvegetated Surface: % |
|---|---|
| | ___ Bedrock ___ Litter, duff ___ Wood ( > 1 cm)<br>___ Large rocks (cobbles, boulders > 10 cm)<br>___ Small rocks (gravel, 0.2–10 cm)<br>___ Sand (0.1–2 mm) ___ Bare soil<br>___ Other: |
| Soil Texture:<br>__ sand ___ loamy sand ___ sandy loam ___ loam<br>__ silt loam ____ silt ___ clay loam<br>___ silty clay ___ clay ___ peat ___ muck | Soil Drainage<br>___ Rapidly drained ___ Well drained<br>___ Moderately well drained ___ Somewhat poorly drained<br>___ Poorly drained ___ Very poorly drained |

VEGETATION DESCRIPTION

| Leaf phenology (of dominant stratum) | Leaf Type (of dominant stratum) | Physiognomic class | Cover Scale for Strata and Unvegetated Surface | Height Scale for Strata |
|---|---|---|---|---|
| Trees and Shrubs<br>___Evergreen<br>___Cold deciduous<br>___Drought deciduous<br>___Mixed evergreen - cold deciduous<br>___Mixed evergreen - drought deciduous<br><br>Herbs<br>___Annual<br>___Perennial | ___Broad-leaved<br>___Needle-leaved<br>___Microphyllous<br>___Graminoid<br>___Forb<br>___Pteridophyte | ___Forest<br>___Woodland<br>___Shrubland<br>___Dwarf-Shrubland<br>___Herbaceous<br>___Nonvascular<br>___Sparsely Vegetated | 1 0–1%<br>2 > 1–5%<br>3 > 5–25%<br>4 > 25–50%<br>5 > 50–75%<br>6 > 75% | 01 < 0.5 m<br>02 0.5–1 m<br>03 1–2 m<br>04 2–5 m<br>05 5–10 m<br>06 10–15 m<br>07 15–20 m<br>08 20–35 m<br>09 35–50 m<br>10 > 50 m |

| | Height/Strata Class | Cover Class | Height to Base (Class) | Dominant Species (mark diagnostics with *) |
|---|---|---|---|---|
| T1 Emergent | _____ | _____ | _____ | _____ |
| T2 Canopy | _____ | _____ | _____ | _____ |
| T3 Subcanopy | _____ | _____ | _____ | _____ |
| S1 Tall shrub | _____ | _____ | _____ | _____ |
| S2 Short shrub | _____ | _____ | _____ | _____ |
| H Herbaceous | _____ | _____ | _____ | _____ |
| N Nonvascular | _____ | _____ | _____ | _____ |
| V Vine/Liana | _____ | _____ | _____ | _____ |
| E Epiphyte | _____ | _____ | _____ | _____ |

Please see above table for height and cover scales.

Animal Use Evidence (including scat, browse, graze, burrows, bedding sites, etc.)

Natural and Anthropogenic Disturbance Comments (Please see cheat sheet for impact codes; list intensity as H, M, or L.)

Other Comments (locations of photos and perm plot marker)

**YOSEMITE VEGETATION MAPPING SPECIES INFORMATION**

Plot Code_____Page_____ of _____

**Cover Class Intervals: 1 (< 1%), 2 (1–5%), 3 (> 5–25%), 4 (> 25–50%), 5 (> 50–75%), 6 (> 75%)**

*G=Ground,Layer S= shrub layer, T = tree layer. Use strata codes on page 2 of form to indicate which strata are represented for ech species.*

| G | S | T | Vascular plant name or moss/lichen cryptogamic crust cover | DBH of all trees greater than 10 centimeters | Cover Class | % |
|---|---|---|---|---|---|---|
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Total Vegetation Cover (Class/%): ____/_____ Total Non-Native (Class/%) _____/_____

# YOSEMITE CODE LIST

**LANDFORM**

**Macro-scale types**
canyon
escarpment
floodplain
glaciated uplands
gorge
hanging valley
hills
island
mountain valley
mountain(s)
mountain valley fan
plateau
ridge and valley
rim
valley floor

**Meso-scale types**
Bedrock outcrop, hillslope
Bedrock outcrop, ridgetop
bench
bottomland
channel
cirque floor fluvial
cirque headwall
cliff
col
colluvial slope
dome
drainage channel (undifferentiated)
draw
earth flow
eroded bench
eroding stream channel system
erosional stream terrace
hillslope bedrock outcrop
knob
knoll
lake/pond
lake bed
lake plain
lake terrace
lateral moraine
lava flow (undifferentiated)
ledge
levee
meander belt
meander scar
moraine (undifferentiated)
mud flat
patterned ground (undifferentiated)
periglacial boulderfield
pinnacle
ravine
ridge
ridgetop bedrock outcrop
riverbed
rock fall avalanche
saddle
scour
seep
slump pond
soil creep slope
stream terrace (undifferentiated)
streambed
swale
talus
tarn

**Micro-scale Types**
linear
mounded
concave
convex
hummocky
undulating

**ASPECT**

| | |
|---|---|
| flat (n/a) | |
| variable | |
| N | 338–22 |
| NE | 23–67 |
| E | 68–112 |
| SE | 113–157 |
| S | 158–202 |
| SW | 203–247 |
| W | 248–292 |
| NW | 293–337 |

**TOPOGRAPHIC POSITION**

| Designation | Synonym(s) |
|---|---|
| Interfluve | crest, summit, upper slope, shoulder slope |
| High level | mesa |
| Midslope | transportational |
| Backslope | dipslope |
| Step in slope | ledge, terracette |
| Lowslope | lower slope, foot |
| Toeslope | alluvial toeslope |
| Low level | terrace |
| Channel wall | bank |
| Channel bed | narrow valley |
| Basin floor | depression |

**SOIL TEXTURE**
Sand
Loamy sand
Sandy loam
Loam
Silt loam
Silt
Clay loam
Silty clay
Clay
Peat
Muck

**DRAINAGE**
Rapidly drained
Well drained
Moderately well drained
Somewhat poorly drained
Poorly drained
Very poorly drained

**SURFICIAL GEOLOGY**
Igneous Rocks: Granitic
Igneous Rocks: Dioritic
Igneous Rocks: Gabbroic
Sedimentary Rocks: Conglomerates and Breccias
Sedimentary Rocks: Sandstone
Sedimentary Rocks: Siltstone
Sedimentary Rocks: Shale
Sedimentary Rocks: Limestone and Dolomite
Metamorphic Rocks: Gneiss
Metamorphic Rocks: Schist
Metamorphic Rocks: Slate and Phyllite
Metamorphic Rocks: Marble
Metamorphic Rocks: Serpentine
Glacial Deposits: Undifferentiated glacial deposit
Glacial Deposits: Till
Glacial Deposits: Moraine
Glacial Deposits: Bedrock and till
Glacial Deposits: Glacial-fluvial deposits
Glacial Deposits: Deltaic deposits
Glacial Deposits: Lacustrine and fluvial deposits
Organic Deposits: Peat
Organic Deposits: Muck
Organic Deposits: Marsh: regularly flooded by lake or river
Slope and Modified Deposits: Talus and scree slopes
Slope and Modified Deposits: Colluvial
Slope and Modified Deposits: Solifluction, landslide
Aeolian Deposits: Aeolian sand flats
Aeolian Deposits: Cover sands

**IMPACTS**
01 Development
02 ORV activity
03 Agriculture
04 Grazing
05 Competition from exotics
06 Logging
07 Insufficient population/stand size
08 Altered flood/tidal regime
09 Mining
10 Hybridization
11 Groundwater pumping
12 Dam/Inundation
13 Other
14 Surface water diversion
15 Road/Trail construction/maint.
16 Biocides
17 Pollution
18 Unknown
19 Vandalism/Dumping/Litter
20 Foot traffic/trampling
21 Improper burning regime
22 Over collecting/poaching
23 Erosion/Runoff
24 Altered thermal regime
25 Landfill
26 Degrading water quality
27 Wood cutting
28 Military operations
29 Recreational use (non ORV)
30 Nest parasitism
31 Non-native predators
32 Rip-rap, bank protection
33 Channelization (human caused)
34 Feral pigs
35 Burros
36 Rills
37 Phytogenic mounding

**Materials checklist**

| | | | |
|---|---|---|---|
| | Plot Survey forms | | Plant species key |
| | Survey form code list | | Species list |
| | Sampling protocol | | Metal plot stakes (1 piece per plot) |
| | Pens/permanent markers | | Two-way radio |
| | Road/trail maps | | Plastic bags to store fresh plant specimens |
| | Tape measures (2) | | Plant press, blotters, and paper |
| | DBH tape | | Accuracy assessment point forms |
| | Compass | | Clipboard/white board |
| | Clinometer | | Dry-erase markers (for white board) |
| | Camera (>/= 3 exposures per plot) | | Most recent version of provisional classification of the park |
| | GPS unit (set to NAD27 datum) | | Number of plots needed per type |

CONSIDERATIONS FOR MISSION PLANNING: PHASE II FIELD SAMPLING FOR YOSEMITE VEGETATION MAPPING PROJECT

**Planning for the Day: (ecologist/team leader)**

1. Decide crew membership
2. Safety and sustenance issues (food, water, first-aid kit, water filter, radio)
3. Field communications
   a. Develop plan with other team for radio check-in time regarding plot types and contingencies for duplication problems
   b. Do you have radio, and are batteries charged?
4. Check GPS (batteries, memory available, priority sample waypoints logged from AIS table)
5. Checklist for all other field equipment
   masking tape and sharpies for labeling specimens
   if longer mission, small plant press with adequate blotters and newspaper
   sufficient field forms for all possible samples
   all ancillary information
6. Plan day's mission before departure using one copy per team of
   a) USGS quad
   b) Hard-copy digital ortho quarter quads with flagged points
   c) Aerial photo with coded overlay
7. Considerations for mission planning
   a. Based on topography, existing access routes, density, and complexity of vegetation (more time for forest and woodland plots, less for herbaceous and scrub)
   b. Based on priority needs (location of clusters of a, b, d, and e polygons and asterisks if possible [if en route to or visible from priority sample polygons])
   c. Based on possible redundancy of other team (adequate alternative samples)

**Planning for the Week: (field coordinator)**

1. With which 7.5-minute quads will you be working? Do you have all appropriate maps, photos, and DOQQs?

2. Develop estimate of reasonable expectations of plots to choose for each team broken up by day and based on estimate of individual team's travel logistics for the week
3. Develop plan of attack for the week to capture all essentials (a, b, and then some d, e, and asterisks)
4. Balance points 2 and 3 above with the expected work schedule of the teams, ensure adequate time off, and reduce overtime concerns.
5. Do you have all necessary information for weekly planning?
   a) AIS DOQQs for the zone
   b) Adequate field copies of air photos (1 per team if both will be working on same photo)
   c) Blank field forms
6. Communication with management team (Peggy, Todd, Jim, Debbie, or some appropriate subset) and field crews
   a. Update matrix of sampled plots by type
   b. All uncertainties dealt with (new types seen, should we sample?, problems with interpreting PI information, personnel issues, problems in interpreting classification/key, park-related logistics)
7. Communication with field crews
   a. Obtain QC'd field forms (allow time for your QC and resolving your questions about the forms with crews)
   b. Obtain all plants not identified (allow time for plant I.D.)
   c. What were their questions about the polygons they visited?
   d. What was accomplished, what was not accomplished?

**Planning for the Ecological Zone: (field coordinator)**

1. Do you have all the tools you need for planning the zone?
   a. Vegetation matrix updated for the zone by AIS and classification team
   b. Vegetation key for zone
   c. All DOQQs and photographs delineated with array of points chosen by AIS accommodations worked out (camping logistics including bear-proofing considerations, temporary residence if on east side or other area remote from Midpines)
2. How many plots of a, b, and d polygons do you need?
3. How many e polygons and green asterisk questions do the PIs have?
4. Factor points 2 and 3 into the equation of days needed and locations focused upon
5. Consider the dispersion of sample plots to capture range of variability
6. Do not shift to new zone or zone group until all targets are adequately captured unless considerations have been discussed by management team.

<u>Clarifications to procedures, made 5/24/99</u>

1. Classification categories for the notation of polygons in the photointerpretation process. These categories refer to both vegetation classification types (as determined by the ecologists) and to polygon signatures that cannot be tied to one of the existing vegetation types. The sampling implications for each are different.

A Type Polygons: **Vegetation types** that have (or are expected to have) a clear photointerpreter signature and do not yet have the requisite number of samples. Collection of field samples for these types is a high priority for both classification and the mapping efforts. Full quantitative plots should be collected for these polygons until the total desired number of plots for each of these types is captured.

B Type Polygons: **Vegetation types** that are not expected to have a clear photointerpreter signature due to standard size of occurrence, shape and pattern of distribution, and complex interdigitation with other associations across the landscape. The priority for sampling these types is high for classification but less important overall than for the A Types because the relationship to map signatures is complex. Vegetation complexes and other environmental descriptors will be developed to provide polygon attributes for these types as they are photointerpreted and encountered on the landscape (see D Type polygons).

C Type Polygons: **Vegetation types** that also have a clear photointerpreter signature and have been sufficiently sampled. These types do not require additional field effort.

D Type Polygons: **Photo signatures** that cannot be interpreted by the photointerpreters in relation to any of the existing vegetation types yet reoccur consistently across an ecological zone. The collection of a sufficient amount of field data for this **signature** is a high priority so that the photointerpreters can attribute these correctly. The field crew will visit a subset of these polygons to determine whether this (1) is a variant of an existing vegetation type or mosaic of existing vegetation types (note the types and take an observation plot) or (2) may represent a new vegetation type (take a plot).

E Type Polygons: **Photo signatures** that cannot be interpreted by the photointerpreters in relation to any of the existing vegetation types and do not reappear consistently across an ecological zone. These types should be visited as possible so that we can figure out how to deal with them in our classification/mapping protocols. Observation point forms should be filled out for E Type polygons visited (with the assumption that none of these would constitute a new global vegetation type).

The order of priority for sampling is therefore A, D, B, E, and C.

2. There are new vegetation types recognized as the result of the ecology/photointerpretation reconnaissance trips to each ecological zone. How should these types be categorized?

   When the ecologist (primarily Todd or Peggy) makes a decision regarding the recognition of a new vegetation type, they will decide whether these should be categorized as Type A or B and will allocate the field sampling needs accordingly. It may be useful during these trips to attempt to determine classification conventions for complex vegetation assemblages that are encountered in the ecological zone.

3. What should the field crews do when they "discover" new vegetation types while in the field?

   When the crew recognizes associations that appear to be repeating in the field with a consistent pattern of composition, structure, and habitat, they should approach this as an A Type and take quantitative samples accordingly. New types should be reviewed as quickly as possible by Todd and Peggy for their assessment.

4. Collecting and keying out plant specimens

When an unknown plant species is encountered in the plot it should be collected. All specimens need to be tagged so the importance of immediate keying can be assessed. Higher priority will be given to specimens that are critical for classification (have a high cover value) and are encountered often across multiple plots (have a high annoyance value). These specimens should be held for keying at the earliest possible time. The identification of these should be shared with the entire field crew so they do not continue to collect them. The other specimens should be labeled and pressed. They will be identified during and after the season by outside experts. All unknowns will eventually be identified and entered into the plot database.

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# Appendix F: Accuracy Assessment Field Form and Instructions

**Instructions for filling out fields in the accuracy assessment survey form (YOSE version June 24, 2002).**

## IDENTIFIERS/LOCATORS Section

**Field Point Code**
Code indicating the specific polygon evaluated.

**State**
CA

**Park Name**
YOSEMITE NP

**Park Site Name**
Provisional name assigned by field worker that describes where the data were collected. It should represent an identifiable feature on a topographic map.

**Quad Name**
Appropriate name/scale from survey map used; use 7.5-minute quadrangle if possible.

**Quad Code**
Code of quadrangle map.

**Primary Veg Assoc Name**
Using the vegetation classification for Yosemite with which you have been provided, assign the name of the vegetation type which most closely resembles the vegetation in the polygon. Enter the finest level of the classification possible. This assignment will be reviewed by ecologists familiar with Park vegetation and the classification to confirm a final assignment. The final assignment will be used to update the tally of AA points needed by vegetation type.

**Secondary Veg Assoc Name**
The second best fit of a type to the vegetation in the polygon. (???)

**Other Veg Assoc within 50m**
List other associations within 50 m of the AA point.

**Classif Comments**
Does the polygon not key well or does it not fit well any types in the classification? Does the polygon key to the alliance level but not association?

**GPS File Name**
File name in which coordinate data are stored .

### Field UTM X
Use GPS; do not estimate. If you can't get a GPS reading, derive coordinates from a topo map and note on the form that this method was used. Note for this and the following field. All field crews have been trained in using a UTM grid and a topo map to estimate their actual UTM coordinates (to approximately within 50 m).

### Field UTM Y

Use GPS; do not estimate. If you can't get a GPS reading, derive coordinates from a topo map and note on the form that this method was used.

### GPS Error (m)

Record from the GPS unit the error, in meters, associated with the UTM coordinate.

**Survey Date**

Date the survey was taken; year, month, day.

**Surveyors**

Names of surveyors, with principal surveyor (usually the Lead Ecologist) listed first.

**Point Representativeness (???)**

Point's representativeness for the polygon: High, Medium, Low + comments. Note additional species not seen at AA point. The former comment may be ascertained by reconnaissance of the polygon.

**ENVIRONMENTAL DESCRIPTION Section**

**Elevation**

Elevation of the plot. **Specify whether in feet or meters** (this will depend on the units used on the GPS or on the topographic map being used). In general, we have determined that the reading you get from a topo map, provided you are certain where you are, is more accurate than the average reading from the GPS unit. Thus, please attempt to estimate your elevation with the topo map.

**Slope**

Measure the slope in degrees using a clinometer or compass.

**Aspect**

Measure the slope aspect using a compass (be sure to correct for the magnetic declination). Note: all compasses have been pre-set to an average declination for the park and thus, readings from the compasses carried by the field crews may be directly noted.

**Topographic Position**

Topographic position of the AA point. Choose one:

> INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.
>
> HIGH SLOPE (shoulder slope, upper slope, convex creep slope). Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.
>
> HIGH LEVEL (mesa). Level top of a plateau.
>
> MIDSLOPE (transportational midslope, middle slope). Intermediate slope position.
>
> BACKSLOPE (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments (fall faces).

STEP IN SLOPE (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.

LOWSLOPE (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toeslope.

TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

LOW LEVEL (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL WALL (bank). Sloping side of a channel.

CHANNEL BED (narrow valley bottom, gully arroyo). Bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

#### Landform

Enter the landform that describes the site where the AA point was taken. Note on the code sheet the landform choices are listed by being either macro, meso, or micro in scale. Thus, one can select one from each of these landscape scales for any sitt (e.g., mountain could be macro and cirque headwall could be meso). Your choices are:

**Macro-scale types:**
canyon
escarpment
flood plain
glaciated uplands
gorge
hanging valley
hills
island
mountain valley
mountain(s)
mountain-valley fan
plateau
ridge & valley
rim
valley floor

**Meso-scale types**
Bedrock outcrop, hillslope
Bedrock outcrop, ridgetop
bench
bottomland
channel
cirque floor fluvial
cirque headwall
cliff
col
colluvial slope
dome
drainage channel
(undifferentiated)
draw
earth flow
eroded bench
eroding stream channel system
erosional stream terrace
hillslope bedrock outcrop
knob
knoll
lake/pond
lake bed
lake plain
lake terrace

lateral moraine
lava flow (undifferentiated)
ledge
levee
meander belt
meander scar
moraine (undifferentiated)
mud flat
patterned ground (undifferentiated)
periglacial boulderfield
pinnacle
ravine
ridge
ridgetop bedrock outcrop
riverbed
rock fall avalanche
saddle
scour
seep
slump pond
soil creep slope
stream terrace (undifferentiated)
streambed
swale
talus
tarn

**Micro-scale Types**
linear
mounded
concave
convex
hummocky
undulating

**Environmental Comments**
Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors.

**Unvegetated Surface**
Estimate the approximate percentage of the total surface area covered by each category. Only include categories with over 5% cover.

## VEGETATION DESCRIPTION Section

### Leaf Phenology
Select the value which best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

EVERGREEN - Greater than 75% of the total woody cover is never without green foliage.

COLD DECIDUOUS - Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

DROUGHT DECIDUOUS - Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by drought.

MIXED EVERGREEN - COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and cold-deciduous species admixed.

MIXED EVERGREEN - DROUGHT DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and drought-deciduous species admixed.

PERENNIAL - Herbaceous vegetation composed of more than 50% perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50% annual species.

**Leaf Type**

Select one value which best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

MICROPHYLLOUS - Woody cover primarily microphyllous.

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF-HERBACEOUS) - Herbaceous vegetation composed of more than 50% broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves.

**Physiognomic Class**

Choose one:

| | |
|---|---|
| Forest: | Trees with their crowns overlapping (generally forming 60-100% cover). |
| Woodland: | Open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively. |
| Shrubland: | Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 25% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation dominated by woody vines is generally treated in this class. |
| Dwarf-Shrubland: | Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively |

| | |
|---|---|
| Herbaceous: | Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively. |
| Nonvascular: | Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively. |
| Sparsely Vegetated: | Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%). |

**Strata/Lifeform, Height, Cover, Diagnostic Species**

Emergent **Tree** (T1): **T**ree strata that averages greater than 10% and is significantly taller than the main canopy for the stand.

**Tree** Canopy (T2): The main tree canopy for the stand over which there may be a scattering of emergent trees and beneath which there may be an understory of sub-canopy trees, shrubs and/or herbs.

**Tree** Sub-Canopy (T3): The small trees that may form a distinct layer beneath the canopy and the emergent trees

Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. Height and Cover classes are also listed below.

Trees are defined as single-stemmed woody plants, generally 5 m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions. Note: Because many trees in California are large multiple-stemmed individuals as a result of past fire or other disturbance, the standard definition of a tree as a woody single-stemmed plant 5 m or more tall has been modified to be any woody plant 5 m or greater in height. A shrub is a woody plant that typically has multiple stems from the base and is less than 5 m in height under optimal conditions. Tree seedlings and saplings are identified in the layer in which they occur (e.g., one could have *Pinus ponderosa* as a component of the herb strata, if there were small saplings, and also of the T2 layer).

List the dominant species in each stratum. If species known to be diagnostic of a particular vegetation type are present, list these as well, marking them with an asterisk.

**Comments**

Any other comments, including percent of polygon assessed and polygon homogeneity.

## Appendix F (continued). NATIONAL PARK VEGETATION MAPPING PROGRAM: ACCURACY ASSESSMENT POINT FORM

**IDENTIFIERS/LOCATORS**

Field Point Code _____ Database Point Code _____

State CA Park Name _____Yosemite_____Park Site Name _____

Quad Name_____ Quad Code_____

Primary Veg Assoc Name _____

Secondary Veg Assoc Name_____

Other Veg Assoc within 50 m _____

Classification Comments: (does it key easily? Are all diagnostic species present in proper proportions? If not how does it differ?)

GPS file name_____Field UTM X__ __ __ __ __ __ m E Field UTM Y__ __ __ __ __ __ __ m N

GPS Error _____ m

*please do not complete the following information when in the field*

Corrected UTM X__ __ __ __ __ __ m E Corrected UTM Y__ __ __ __ __ __ __ m N UTM Zone_____

Survey Date_____

Surveyors_____

**ENVIRONMENTAL DESCRIPTION**

Elevation _____ Slope _____ Aspect_____

Topographic Position

Landform

| Environmental Comments (including hydrology, fire history, has veg. in polygon changed since photos?): | Unvegetated Surface: *(please use the cover scale below)*<br>___ Bedrock<br>___ Litter, duff<br>___ Wood ( > 1 cm)<br>___ Large rocks (cobbles, boulders > 10 cm)<br>___ Small rocks (gravel, 0.2-10 cm)<br>___ Sand (0.1-2 mm)<br>___ Bare soil<br>___ Other:_____ |
|---|---|

## VEGETATION DESCRIPTION

| Leaf phenology (of dominant stratum) | Leaf Type (of dominant stratum) | Physiognomic class | Cover Scale for Unvegetated Surface |
|---|---|---|---|
| <u>Trees and Shrubs</u> | | | |
| ___Evergreen | ___Broad-leaved | ___Forest | 01 5% |
| ___Cold-deciduous | ___Needle-leaved | ___Woodland | 02 10% |
| ___Drought-deciduous | ___Mixed broad-leaved/Needle leaved | ___Shrubland | 03 20% |
| ___Mixed evergreen - cold-deciduous | ___Microphyllous | ___Dwarf Shrubland | 04 30% |
| ___Mixed evergreen - drought-deciduous | ___Graminoid | ___Herbaceous | 05 40% |
| <u>Herbs</u> | ___Forb | ___Nonvascular | 06 50% |
| ___Annual | ___Pteridophyte | ___Sparsely Vegetated | 07 60% |
| ___Perennial | | | 08 70% |
| | | | 09 80% |
| | | | 10 90% |
| | | | 11 100% |

| Strata | Height | Cover Class | Dominant species (mark diagnostic species with a * ) | Cover Class |
|---|---|---|---|---|
| T1 Emergent | _____ | _____ | _____ | |
| T2 Canopy | _____ | _____ | _____ | |
| T3 Sub-canopy | _____ | _____ | _____ | |
| S1 Tall shrub | _____ | _____ | _____ | |
| S2 Short Shrub | _____ | _____ | _____ | |
| S3 Dwarf-shrub | _____ | _____ | _____ | |
| H Herbaceous | _____ | _____ | _____ | |
| N Non-vascular | _____ | _____ | _____ | |
| V Vine/liana | _____ | _____ | _____ | |
| E Epiphyte | _____ | _____ | _____ | |

AA Comments (describe polygon heterogeneity; how much assessed?; aa certainty?)

| Cover Scale: Strata and Species | | Height Scale: Strata | |
|---|---|---|---|
| 01 | 5% | 01 | <0.5 m |
| 02 | 10% | 02 | 0.5-1 m |
| 03 | 20% | 03 | 1-2 m |
| 04 | 30% | 04 | 2-5 m |
| 05 | 40% | 05 | 5-10 m |
| 06 | 50% | 06 | 10-15 m |
| 07 | 60% | 07 | 15-20 m |
| 08 | 70% | 08 | 20-35 m |
| 09 | 80% | 09 | 35-50 m |
| 10 | 90% | 10 | >50 m |
| 11 | 100% | | |

# Appendix G: Yosemite National Park Mapping and Classification Project Digital Orthophoto Quarter Quadrangles (DOQQ) Used in Georectification

Published USGS digital orthophoto quarter quadrangles used in the Yosemite National Park Vegetation Mapping Project to rectify photointerpreted line work. The purpose of the rectification was to match the positional accuracy of the DOQQs. The 7.5 minute quadrangles are listed by name and the DOQQs used for rectification are listed by code corresponding to the northwest, northeast, southwest, or southeast quarter.

| Digital Orthophoto 7.5 Minute Quadrangle Names | Abbreviations for Digital Orthophoto Quarter Quadrangles (DOQQs) Used in YOSE Rectification and Dates of Publication | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Code | Date | Code | Date | Code | Date | Code | Date |
| Ackerson Mountain | ACMO_NE | 9/18/1998 | ACMO_NW | 9/18/1998 | ACMO_SE | 9/18/1998 | ACMO_SW | 9/18/1998 |
| Ascension Mountain | ASMO_NE | 9/18/1998 | ASMO_NW | 9/18/1998 | ASMO_SE | 9/18/1998 | ASMO_SW | 9/18/1998 |
| Big Alkali | BIAL_NW | 9/19/1998 | BIAL_SE | 9/19/1998 | BIAL_SW | 9/19/1998 | | |
| Buckingham Mountain | BUMO_NE | 8/1/1999 | BUMO_NW | 9/18/1998 | BUMO_SE | 9/18/1998 | BUMO_SW | 9/18/1998 |
| Buckeye Ridge | BURI_NE | 8/26/1998 | BURI_NW | 8/26/1998 | BURI_SE | 8/26/1998 | BURI_SW | 8/26/1998 |
| Cattle Mountain | CAMO_NE | 9/18/1998 | CAMO_NW | 9/18/1998 | CAMO_SE | 9/10/1998 | CAMO_SW | 9/18/1998 |
| Cherry Lake North | CLNO_NE | 9/18/1998 | CLNO_SE | 9/18/1998 | CLNO_SW | 9/19/1998 | | |
| Cherry Lake South | CLSO_NE | 9/18/1998 | CLSO_NW | 9/18/1998 | CLSO_SE | 9/18/1998 | CLSO_SW | 9/18/1998 |
| Cooper Peak | COPE_NE | 9/18/1998 | COPE_SE | 9/18/1998 | COPE_SW | 8/25/1998 | | |
| Crystal Crag | CRCR_NE | 8/26/1998 | CRCR_NW | 8/26/1998 | CRCR_SW | 8/26/1998 | | |
| Dunderberg Peak | DUPE_NE | 9/18/1998 | DUPE_NW | 9/18/1998 | DUPE_SE | 9/18/1998 | DUPE_SW | 9/18/1998 |
| El Capitan | ELCA_NE | 8/1/1999 | ELCA_NW | 8/1/1999 | ELCA_SE | 8/1/1999 | ELCA_SW | 8/1/1999 |
| El Portal | ELPO_NE | 8/1/1999 | ELPO_NW | 9/18/1998 | ELPO_SE | 8/1/1999 | ELPO_SW | 9/18/1998 |
| Emigrant Lake | EMLA_NE | 9/18/1998 | EMLA_NW | 9/18/1998 | EMLA_SE | 9/18/1998 | EMLA_SW | 9/18/1998 |
| Fales Hot Springs | FHSP_SE | 8/26/1998 | FHSP_SW | 8/26/1998 | | | | |
| Falls Ridge | FARI_NE | 9/24/1993 | FARI_NW | 9/24/1993 | FARI_SE | 9/24/1993 | FARI_SW | 9/24/1993 |
| Feliciana Mountain | FEMO_NE | 8/20/1998 | | | | | | |
| Fish Camp | FICA_NE | 9/18/1998 | FICA_NW | 9/18/1998 | | | | |
| Half Dome | HADO_NE | 6/22/1987 | HADO_NW | 6/22/1987 | HADO_SE | 7/2/1987 | HADO_SW | 6/22/1987 |
| Hetch Hetchy Reservoir | HHRE_NE | 9/26/1993 | HHRE_NW | 7/16/1993 | HHRE_SE | 9/26/1993 | HHRE_SW | 7/16/1993 |
| Jawbone Ridge | JARI_NE | 8/29/1998 | JARI_SE | 8/29/1998 | | | | |
| June Lake | JULA_NW | 8/3/1999 | JULA_SW | 8/26/1998 | | | | |
| Kibbie Lake | KILA_NE | 9/18/1998 | KILA_NW | 9/18/1998 | KILA_SE | 9/18/1998 | KILA_SW | 9/18/1998 |
| Kinsley | KINS_NE | 9/18/1998 | KINS_SE | 8/20/1998 | | | | |
| Koip Peak | KOPE_NE | 8/3/1999 | KOPE_NW | 8/3/1999 | KOPE_SE | 9/18/1998 | KOPE_SW | 9/18/1998 |

| Digital Orthophoto 7.5 Minute Quadrangle Names | Abbreviations for Digital Orthophoto Quarter Quadrangles (DOQQs) Used in YOSE Rectification and Dates of Publication | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Code | Date | Code | Date | Code | Date | Code | Date |
| Lake Eleanor | LAEL_NE | 9/18/1998 | LAEL_NW | 9/18/1998 | LAEL_SE | 9/18/1998 | LAEL_SW | 9/18/1998 |
| Lee Vining | LEVI_NW | 8/3/1999 | LEVI_SW | 8/3/1999 | | | | |
| Little Shuteye Peak | LSPE_NW | 9/18/1998 | LSPE_NE | 7/30/1999 | | | | |
| Lundy | LUND_NE | 9/18/1998 | LUND_NW | 9/18/1998 | LUND_SE | 8/3/1999 | LUND_SW | 8/3/1999 |
| Mariposa Grove | MAGR_NE | 8/26/1998 | MAGR_NW | 8/26/1998 | MAGR_SE | 9/18/1998 | MAGR_SW | 9/18/1998 |
| Mammoth Mountain | MAMO_NE | 8/26/1998 | MAMO_NW | 8/26/1998 | MAMO_SE | 8/26/1998 | MAMO_SW | 8/26/1998 |
| Matterhorn Peak | MAPE_NE | 8/26/1998 | MAPE_NW | 8/26/1998 | MAPE_SE | 8/26/1998 | MAPE_SW | 8/26/1998 |
| Merced Peak | MEPE_NE | 9/24/1993 | MEPE_NW | 9/24/1993 | MEPE_SE | 9/24/1993 | MEPE_SW | 9/24/1993 |
| Mount Dana | MODA_NE | 8/3/1999 | MODA_NW | 8/3/1999 | MODA_SE | 8/3/1999 | MODA_SW | 8/3/1999 |
| Mount Jackson | MOJA_SE | 9/19/1998 | MOJA_SW | 9/19/1998 | | | | |
| Mount Lyell | MOLY_NE | 9/18/1998 | MOLY_NW | 9/18/1998 | MOLY_SE | 9/18/1998 | MOLY_SW | 9/18/1998 |
| Mount Ritter | MORI_NE | 9/18/1998 | MORI_NW | 9/18/1998 | MORI_SE | 9/18/1998 | MORI_SW | 9/18/1998 |
| Pickel Meadow | PIME_SE | 8/25/1998 | PIME_SW | 8/25/1998 | | | | |
| Pinecrest | PINE_SE | 8/25/1998 | | | | | | |
| Piute Mountain | PIMO_NE | 9/24/1993 | PIMO_NW | 9/26/1993 | PIMO_SE | 9/24/1993 | PIMO_SW | 9/26/1993 |
| Sing Peak | SIPE_NE | 8/26/1998 | SIPE_NW | 8/26/1998 | SIPE_SE | 9/18/1998 | SIPE_SW | 9/18/1998 |
| Tamarack Flat | TAFL_NE | 6/22/1987 | TAFL_NW | 7/13/1987 | TAFL_SE | 6/22/1987 | TAFL_SW | 7/13/1987 |
| Ten Lakes | TELA_NE | 9/24/1993 | TELA_NW | 9/26/1993 | TELA_SE | 9/24/1993 | TELA_SW | 9/26/1993 |
| Tenaya Lake | TENA_NE | 9/24/1993 | TENA_NW | 9/24/1993 | TENA_SE | 9/24/1993 | TENA_SW | 9/24/1993 |
| Timber Knob | TIKN_NE | 9/18/1998 | TIKN_NW | 9/18/1998 | TIKN_SE | 9/19/1998 | TIKN_SW | 9/19/1998 |
| Tiltill Mountain | TIMO_NE | 9/18/1998 | TIMO_NW | 9/18/1998 | TIMO_SE | 9/18/1998 | TIMO_SW | 9/18/1998 |
| Tioga Pass | TIPA_NE | 9/18/1998 | TIPA_NW | 9/18/1998 | TIPA_SE | 9/18/1998 | TIPA_SW | 9/18/1998 |
| Tower Peak | TOPE_NE | 8/25/1998 | TOPE_NW | 8/25/1998 | TOPE_SE | 8/25/1998 | TOPE_SW | 8/25/1998 |
| Twin Lakes | TWLA_NE | 9/19/1998 | TWLA_NW | 9/19/1998 | TWLA_SE | 9/19/1998 | TWLA_SW | 9/19/1998 |
| Vogelsang Peak | VOPE_NE | 9/18/1998 | VOPE_NW | 9/18/1998 | VOPE_SE | 9/18/1998 | VOPE_SW | 9/18/1998 |
| Wawona | WAWO_NE | 8/1/1999 | WAWO_NW | 8/1/1999 | WAWO_SE | 9/18/1998 | WAWO_SW | 9/18/1998 |
| White Chief Mountain | WCMO_NE | 9/18/1998 | WCMO_NW | 9/18/1998 | | | | |
| Yosemite Falls | YOFA_NE | 8/18/1998 | YOFA_NW | 8/15/1998 | YOFA_SE | 8/18/1998 | YOFA_SW | 8/15/1998 |

# Appendix H: Yosemite National Park Mapping Classification

**Note**: **Codes** in bold were used to label polygons in the final map in the PIFINAL field; other codes are to provide hierarchical context. Underlined codes were used also in the vegetation map for Sequoia and Kings Canyon National Parks. **Gray** text is for codes occurring in the PIPREFINAL field only; they are for users interested in additional detail in particular types. Annotations indicating whether density or land use was assigned reflect that photointerpreters assigned canopy density codes (1-6, see Photointerpretation Mapping Procedures in the Methods section) to polygons of some sparsely vegetated types and land use codes to polygons interpreted as urban/developed. Numbers in parentheses following names indicate the class was mapped only within the ecological zone number(s) listed (see zone descriptions on page 5).

0000 = Sparsely Vegetated/Miscellaneous Classes
**0100** = **Alpine Talus Slope** (5 & 6) (density assigned)
- **0101 = Alpine Talus Slope - Concave Northerly (see 0100)**
- **0102 = Alpine Talus Slope - Concave Southerly (see 0100)**
- **0103 = Alpine Talus Slope - Convex Northerly (see 0100)**
- **0104 = Alpine Talus Slope - Convex Southerly (see 0100)**

**0200** = **Alpine Scree Slope** (5 & 6) (density assigned)
- **0201 = Alpine Scree Slope - Concave Northerly (see 0200)**
- **0202 = Alpine Scree Slope - Concave Southerly (see 0200)**
- **0203 = Alpine Scree Slope - Convex Northerly (see 0200)**
- **0204 = Alpine Scree Slope - Convex Southerly (see 0200)**

**0300** = **Alpine Snow Patch Communities** (5 & 6) (no density assigned)
**0500** = **Mesic Rock Outcrop** (4, 5 & 6) (no density assigned)
**0700** = **Boulder Field** (5 & 6) (no density assigned)
0900 = Sparsely Vegetated/Miscellaneous Classes (continued)
- **0910 = Conifer Reproduction** (density assigned)
- **0920** = **Conifer Plantation** (density assigned)
- **0940 = Sparsely Vegetated Undifferentiated**
  - **0941 = Sparsely Vegetated Riverine Flat**
- **0950 = Non-alpine Talus**
- 0960 = Rock Outcrop Undifferentiated
  - **0961 = Sparsely Vegetated to Non-vegetated Exposed Rock**
  - **0963 = Dome**
  - **0964 = Fissured Rock Outcrop**
  - **0965 = Sparsely Vegetated Rocky Streambed**
- **0970 = Alpine Permanent Snowfield/Glacier**
- **0980 = Water**
  - **0981 = Permanently Flooded, Emergent, or Floating Vegetation Mapping Unit** (no density assigned)
- **0990 = Urban/Developed** (land use assigned)

1000 = Broadleaf Evergreen Trees
- **1020 = Canyon Live Oak Forest Alliance** (1 & 2)
  - **1022 = Canyon Live Oak/Whiteleaf Manzanita Forest Association** (2)
  - **1023 = Canyon Live Oak-(Ponderosa Pine-Incense-cedar) Forest Superassociation** (2)
  - **1024 = Canyon Live Oak-California Laurel Forest Association** (2)
  - **1026 = Canyon Live Oak-Gray Pine Forest Association** (1)
  - **1029 = Canyon Live Oak/Greenleaf Manzanita Forest Association** (2)
- 1040 = Interior Live Oak Woodland Alliance (1)
  - **1043 = Interior Live Oak-Canyon Live Oak Woodland Association** (1)
- 1500 – 1990 = Superalliances and Alliance-level Mapping Units
  - **1510 = Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit** (1 & 2)
  - **1520 = Blue Oak-(Interior Live Oak-Gray Pine/Buckbrush/Annual Grass) Woodland**

**Mapping Unit** (1)
**1530 = Interior Live Oak Woodland & Shrubland Superalliance** (1)
2000 = Broadleaf Deciduous Trees
**2010 = Quaking Aspen Forest Alliance** (3, 7, & 8) (see also 3010s for more quaking aspen classes) (includes 2012 and 2017)
**2011 = Quaking Aspen/California False Hellebore Forest Association** (4 & 7)
**2012 = Quaking Aspen/Mountain Monardella Forest Association** (4) (see 2010)
**2013 = Quaking Aspen/Willow spp. Forest Mapping Unit** (7 & 8)
**2014 = Quaking Aspen/Willow spp. Talus Mapping Unit** (7)
**2015 = Quaking Aspen-Jeffrey Pine/(Big Sagebrush) Forest Association** (8)
**2016 = Quaking Aspen/Big Sagebrush Forest Superassociation** (8)
**2017 = Quaking Aspen/Meadow Mapping Unit** (7 & 8) (see 2010)
**2020 = California Black Oak Forest Alliance** (2 & 3)
**2021 = California Black Oak/Greenleaf Manzanita Forest Association** (2)
**2022 = California Black Oak-Incense-cedar Forest Association** (2)
***2025* = California Black Oak/(Bracken Fern) Forest Mapping Unit** (2)
2030 = Blue Oak Woodland Alliance (1) (see also code 1520)
**2040 = Valley Oak Woodland Alliance** (1)
**2050 = Black Cottonwood Temporarily Flooded Forest Alliance** (2, 7, & 8)
**2052 = Black Cottonwood-Quaking Aspen-(Jeffrey Pine)/Willow spp. Mapping Unit** (7 & 8)
**2070 = Mountain Alder Mapping Unit** (4)
2500 – 2990 = Superalliances and Alliance-level Mapping Units
**2510 = Willow spp. Forest Mapping Unit** (1 & 2)
**2520 = White Alder & Bigleaf Maple Forest Superalliance** (2 & 3)
3000 = Needleleaf Evergreen Pine Trees
**3010 = Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Forest Mapping Unit** (4 & 8)
**3011 = Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Forest Mapping Unit** (8) (see 3010)
**3012 = Sierra Lodgepole Pine-Quaking Aspen/(Kentucky Bluegrass) Forest Mapping Unit** (8)
**3020 = Sierra Lodgepole Pine Forest Alliance** (4, 5, & 7)
**3022 = Sierra Lodgepole Pine/(Bog Blueberry) Forest Mapping Unit** (4)
**3026 = Sierra Lodgepole Pine Woodlands Superassociation** (4 & 7)
**3027 = Sierra Lodgepole Pine/(Big Sagebrush-Roundleaf Snowberry-Currant-Red Mountainheather) Forest Mapping Unit (4 & 7)**
**3028 = Sierra Lodgepole Pine-(Whitebark Pine)/(Ross Sedge-Shorthair Sedge) Forest Superassociation (4, 5, & 7)**
3040 = Sierra Lodgepole Pine Alliance (continued) [use code 3020]
**3047 = Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Forest Mapping Unit (4)**
**3048 = Sierra Lodgepole Pine Mesic Forest Superassociation (4)**
**3049 = Sierra Lodgepole Pine Xeric Forest Superassociation (4)**
**3050 = Ponderosa Pine Woodland Alliance (2)**
**3053 = Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association (2)**
**3060 = Ponderosa Pine-Incense-cedar Forest Alliance (2)**
**3066 = Ponderosa Pine-Incense-cedar-(California Black Oak-Canyon Live Oak) Forest Superassociation (2)**
**3070 = Jeffrey Pine Woodland Alliance (3, 4, & 8)**
**3072 = Jeffrey Pine/Greenleaf Manzanita Woodland Association (3)**
**3073 = Jeffrey Pine/Whitethorn Ceanothus Woodland Association (3)**
**3075 = Jeffrey Pine/Huckleberry Oak Woodland Association (4)**
**3076 = Jeffrey Pine/Antelope Bitterbrush Woodland Association (8)**
3080 = Jeffrey Pine Alliance (continued) [use code 3070]

**3081 = Jeffrey Pine–Singleleaf Pinyon Pine Woodland Association** (8)
**3082 = Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland Association** (8)
**3083 = Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland Association** (8)
**3084 = Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association** (3)
**3085 = Jeffrey Pine-California Red Fir Woodland Association** (4)
**3090 = Gray Pine Woodland Alliance** (1 & 2)
**3097 = Gray Pine-Interior Live Oak/(Whiteleaf Manzanita-Buckbrush-Chamise) Woodland Superassociation** (1 & 2)
3100 = Knobcone Pine Woodland Alliance (1)
**3101 = Knobcone Pine/Whiteleaf Manzanita Woodland Association** (1)
**3102 = Knobcone Pine-Canyon Live Oak Woodland Mapping Unit** (1)
**3105 = Knobcone Pine/Chamise Woodland Association** (1)
**3110 = Singleleaf Pinyon Pine Woodland Alliance** (8)
**3112 = Singleleaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big Sagebrush-Antelope Bitterbrush Woodland Association** (8)
**3113 = Singleleaf Pinyon Pine/(Desert Gooseberry-Big Sagebrush/Squirreltail) Woodland Superassociation** (8)
3130 = Western White Pine Woodland Alliance (4 & 7)
**3131 = Western White Pine/Western Needlegrass Woodland Mapping Unit** (4)
**3140 = Whitebark Pine Woodland Alliance** (4, 5, & 7)
**3143 = Whitebark Pine/(Ross Sedge-Shorthair Sedge) Woodland Superassociation** (4 & 5)
**3147 = Whitebark Pine-Mountain Hemlock Woodland Association** (4, 5, & 7)
**3149 = Whitebark Pine-(Sierra Lodgepole Pine-Mountain Hemlock) Krummholz Conifer Mapping Unit** (4, 5, & 7)
**3150 = Limber Pine Woodland Alliance** (4 & 7)
4000 = Needleleaf Evergreen Conical-form Trees
4010 = Douglas-fir Forest Alliance (2)
**4012 = Douglas-fir-Canyon Live Oak Forest Association** (2)
**4014 = Douglas-fir-White Alder Forest Association** (2)
**4020 = Giant Sequoia Forest Alliance** (3)
**4021 = Giant Sequoia-Sugar Pine/Pacific Dogwood Forest Association** (3)
4030 = Mountain Hemlock Forest Alliance [included as code 4035] (4, 5, & 7)
**4035 = Mountain Hemlock-(Western White Pine-Sierra Lodgepole Pine) Forest Superassociation** (4, 5, & 7)
4050 = California Red Fir Forest Alliance [included as code 4056] (4 & 7)
**4056 = California Red Fir-(Sierra Lodgepole Pine) Forest Superassociation** (4 & 7)
4060 = California Red Fir Forest Alliance (continued)
**4069 = California Red Fir-(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation** (4 & 7)
**4070 = California Red Fir–White Fir Forest Alliance** (3 & 7)
**4074 = California Red Fir-White Fir-(Sugar Pine-Jeffrey Pine) Forest Superassociation** (see 4070) (3 & 7)
4080 = White Fir-Sugar Pine Forest Alliance [included as code 4530] (3 & 7)
**4085 = White Fir East Side Mapping Unit** (7)
**4100 = Sierra Juniper Woodland Alliance** (4, 7, & 8)
**4101 = Sierra Juniper/(Oceanspray) Woodland Superassociation** (4)
**4107 = Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland Association** (8)
4110 = Incense-cedar Forest Alliance (2)
**4111 = Incense-cedar-White Alder Forest Association** (2)
4500 – 4900 = Superalliances and Alliance-level Mapping Units
**4510 = Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance** (4 & 7)

**4520 = White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/(Pinemat Manzanita-Whitethorn Ceanothus) Forest Mapping Unit** (3 & 4)
**4530 = White Fir-Sugar Pine-(Incense-cedar-Jeffrey Pine) Forest Mapping Unit** (3)
**4550 = Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit** (2)

5000 = Evergreen Shrubs
5020 = Chamise Shrubland Alliance (1)
**5021 = Chamise Shrubland Association** (1)
5040 = Interior Live Oak Shrubland Alliance (1)
**5041 = Interior Live Oak-California Buckeye Shrubland Association** (1)
**5060 = Chaparral Whitethorn Shrubland Alliance** (1)
**5110 = Whitethorn Ceanothus Shrubland Alliance** (3)
**5120 = Snowbrush Ceanothus Shrubland Alliance** (7 & 8)
**5130 = Mountain Misery Dwarf-shrubland Alliance** (2)
**5131 = Mountain Misery-Manzanita spp. Mapping Unit (2)**
**5160 = Big Sagebrush Shrubland Alliance** (7 & 8)
**5210 = Low Sagebrush Dwarf-shrubland Alliance** (7 & 8)
**5230 = Curl-leaf Mountain Mahogany Woodland Alliance** (8)
**5240 = Antelope Bitterbrush Shrubland Alliance** (7 & 8)
**5250 = (Silver Lupine)/Brome spp. Shrubland Mapping Unit** (1)
**5260 = Big Sagebrush-(Silver Sagebrush) Shrubland Mapping Unit** (8)
5500 – 5990 = Superalliances and Alliance-level Mapping Units
**5510** = **Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance** (4, 5, 6, & 7)
**5560 = Chamise-(Buckbrush-Whiteleaf Manzanita) Shrubland Mapping Unit** (1)
**5570 = Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Superalliance** (3 & 4)
**5580 = Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance** (1)

6000 = Deciduous Shrubs
**6010 = Deerbrush Shrubland Alliance** (2)
**6012 = Deerbrush-Whiteleaf Manzanita Shrubland Association** (2)
**6020 = Oregon White Oak Shrubland Alliance** (1)
**6110 = Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance** (4 & 5)
6500 – 6990 = Superalliances and Alliance-level Mapping Units
**6500 = Willow spp./Meadow Shrubland Mapping Unit** (2, 3, 4, 7, & 8)
**6502 = Willow spp. Riparian Shrubland Mapping Unit (8) (see 6600)**
**6503 = Willow spp./Meadow Shrubland Mapping Unit (8) (see 6500)**
**6504 = Willow spp. Riparian Shrubland Mapping Unit (7) (see 6600)**
**6505 = Willow spp./Meadow Shrubland Mapping Unit (7) (see 6500)**
**6506 = Willow spp. Talus Shrubland Mapping Unit (7) (see 6700)**
**6507 = Willow spp./Meadow Shrubland Mapping Unit (3) (see 6500)**
**6508 = Willow spp. Riparian Shrubland Mapping Unit (3) (see 6600)**
**6510 = Willow spp./Meadow Shrubland Mapping Unit (4) (see 6500)**
**6511 = Willow spp. Riparian Shrubland Mapping Unit (4) (see 6600)**
**6512 = Willow spp. Talus Shrubland Mapping Unit (2, 3. 4) (see 6700)**
**6513 = Willow spp. Riparian Shrubland Mapping Unit (2) (see 6600)**
**6514 = Willow spp./Meadow Shrubland Mapping Unit (2) (see 6500)**
**6515 = Willow spp. Riparian Shrubland Mapping Unit (1) (see 6600)**
**6600 = Willow spp. Riparian Shrubland Mapping Unit** (2, 3, 4, 7, & 8)
**6700 = Willow spp. Talus Shrubland Mapping Unit** (2, 3, 4, & 7)
**6900 = Mesic Montane Shrubland Mapping Unit** (3 & 4)

7000 = Upland Herbaceous
**7120 = Shorthair Sedge Herbaceous Alliance** (4, 5, & 6)
**7260 = California Annual Grassland/Herbland Superallliance** (1 & 2)

7500 – 7990 = Upland and Upland Meadow Mapping Units

**7550 = Upland Graminoids** (2, 3, 4 & 8)

**7500 = Upland continuous-forming graminoids [light signature]** (3) (see 7550)

**7501 = Upland bunch-forming graminoids [light signature (white), slope (deergrass, …)]** (1) (see 7550)

**7510 = Upland continuous-forming graminoids [light signature]** (2) (see 7550)

**7511 = Upland continuous-forming graminoids, with tall "forb" present [grayer signature]** (2) (see 7550)

**7512 = Upland clonal (?) circular-forming graminoids [orange-brown mottled signature]** (2) (see 7550)

**7530 = Upland continuous-forming graminoids, Lower East Side [light medium gray signature]** (8) (see 7550)

**7540 = Upland herbaceous on volcanics (**4) (see 7550)

**7541 = Upland herbaceous on non-volcanics** (4) (see 7550)

**7701 = Post-clearcut Shrub/Herbaceous Mapping Unit** (Zones 1 & 2)

**7702 = Mesic Post Fire Herbaceous Mapping Unit**

**8000 = Intermittently to Seasonally Flooded Meadow**

**8502 = Intermittently to Seasonally Flooded Meadow (continuous-forming graminoids, low elevation meadow [dark red-bright red even signature) (1)**

**8510 = Intermittently to Seasonally Flooded Meadow (continuous-forming graminoids, mid elevation meadow [pink-red mottled signature]) (2)**

**8511 = Intermittently to Seasonally Flooded Meadow (continuous-forming graminoids, mid elevation meadow [orange-red-orange mottled signature]) (2)**

**8512 = Intermittently to Seasonally Flooded Meadow (some clumping seen, graminoids, mid elevation meadow [dark red mottled signature]) (2)**

**8513 = Intermittently to Seasonally Flooded Meadow (continuous-forming graminoids, mid elevation meadow, only saturated if on slope [pink-red mottled signature]) (2)**

**8514 = Intermittently to Seasonally Flooded River Sandbar Forb [pink-red mottled signature] (1 & 2)**

**8515 = Intermittently to Seasonally Flooded Meadow (continuous forming graminoids, mid elevation meadow [light brown-orange-light gray signature]) (2)**

**8530 = Intermittently to Seasonally Flooded Meadow (continuous lower east side [pink-red signature]) (8)**

**8531 = Intermittently to Seasonally Flooded Meadow (continuous lower east side [orange-brown mottled signature]) (8)**

**8532 = Intermittently to Seasonally Flooded Meadow (continuous lower east side [light tan to light pink signature]) (8)**

**8533 = Intermittently to Seasonally Flooded Meadow (continuous lower east side [gray-brown signature]) (8)**

**8540 = Intermittently to Seasonally Flooded Meadow (continuous upper east side [pink-red signature]) (7)**

**8541 = Intermittently to Seasonally Flooded Meadow (continuous upper east side [orange-brown mottled signature) (7)**

**8542 = Intermittently to Seasonally Flooded Meadow (continuous upper east side [light tan to light pink signature]) (7)**

**8543 = Intermittently to Seasonally Flooded Meadow (continuous upper east side [gray-brown signature]) (7)**

**8544 = Intermittently to Seasonally Flooded Meadow (continuous-forming graminoids upper east side [orange signature]) (7)**

**8550 = Intermittently to Seasonally Flooded Meadow ((NWI j or a) continuous [signature light pink to magenta, even, slightly mottled]) (3)**

**8551 = Intermittently to Seasonally Flooded Meadow ((NWI c or d) continuous [signature orange-brown, usually highly mottled]) (3)**

**8552 = Intermittently to Seasonally Flooded Meadow ((NWI j or a) continuous**

[signature very light tan to light gray, slight mottling]) (3)
8555 = Intermittently to Seasonally Flooded Meadow ((NWI e) continuous [signature light pink to magenta, even, slightly mottled]) (3)
8557 = Intermittently to Seasonally Flooded Meadow ((NWI e) continuous [signature very light tan to light gray, slight mottling) (3)
8558 = Intermittently to Seasonally Flooded Meadow ((NWI b) continuous [signature orange-brown, usually highly mottled) (3)
8560 = Intermittently to Seasonally Flooded Meadow ((NWI j or a) continuous [signature light pink to magenta, even, slightly mottled]) (4)
8561 = Intermittently to Seasonally Flooded Meadow ((NWI c or d) continuous [signature orange-brown, usually highly mottled]) (4)
8562 = Intermittently to Seasonally Flooded Meadow ((NWI j or a) continuous [signature very light tan to light gray, slight mottling]) (4)
8565 = Intermittently to Seasonally Flooded Meadow ((NWI e) continuous [signature light pink to magenta, even, slightly mottled]) (4)
8567 = Intermittently to Seasonally Flooded Meadow ((NWI e) continuous [signature very light tan to light gray, slight mottling]) (4)
8568 = Intermittently to Seasonally Flooded Meadow (NWI b) continuous [signature orange-brown, usually highly mottled]) (4)
8571 = Intermittently to Seasonally Flooded Meadow ((NWI c or d) continuous [signature orange to brown, usually highly mottled]) (5 & 6)
8572 = Intermittently to Seasonally Flooded Meadow ((NWI b) continuous [signature orange to brown, usually highly mottled]) (5 & 6)

**9000 = Semi-permanently to Permanently Flooded Meadow**

9030 = Bullrush-Cattail Mapping Unit (1 & 2)

9500 – 9990 = Meadow Mapping Units

9501 = Semi-permanently to Permanently Flooded Meadow (continuous-forming graminoid, mid elevation meadow [pink even signature]) (2)
9502 = Semi-permanently to Permanently Flooded Meadow (mid elevation meadow [orange to red-orange mottled signature]) (2)
9503 = Semi-permanently to Permanently Flooded Meadow (mid elevation meadow, only saturated if on slope [very dark red-brown mottled signature]) (2)
9510 = Semi-permanently to Permanently Flooded Meadow (continuous-forming grassland, mid elevation meadow, only saturated if on slope [orange to orange-red mottled signature) (2)
9530 = Semi-permanently to Permanently Flooded Meadow (continuous lower east side [pink-red signature]) (8)
9531 = Semi-permanently to Permanently Flooded Meadow (continuous lower east side [dark brown mottled signature]) (8)
9540 = Semi-permanently to Permanently Flooded Meadow (continuous upper east side [pink-red signature]) (7)
9541 = Semi-permanently to Permanently Flooded Meadow (continuous upper east side [dark brown mottled signature]) (7)
9542 = Semi-permanently to Permanently Flooded Meadow (continuous-forming graminoids, upper east side [orange signature]) (7)
9550 = Semi-permanently to Permanently Flooded Meadow ((NWI f, g or h) [signature dark orange to dark brown, usually highly mottled]) (3)
9551 = Semi-permanently to Permanently Flooded Meadow, ((NWI b) [signature dark orange to dark brown, usually highly mottled]) (3)
9552 = Semi-permanently to Permanently Flooded Meadow ((NWI f, g, or H) [medium gray-brown even signature]) (3)
9560 = Semi-permanently to Permanently Flooded Meadow ((NWI f, g or h) [signature dark orange to dark brown, usually highly mottled]) (4)
9561 = Semi-permanently to Permanently Flooded Meadow ((NWI b) [signature dark orange to dark brown, usually highly mottled]) (4)
9570 = Semi-permanently to Permanently Flooded Meadow ([signature dark orange to

**dark brown, usually highly mottled]) (5 & 6)**

**9571 = Semi-permanently to Permanently Flooded Meadow ([signature dark orange to dark brown, usually highly mottled]) (5 & 6)**

# Appendix I: Classification of Vegetation of Yosemite National Park and Environs Based on the National Vegetation Classification Hierarchy

Classification Version June 14, 2001 (with minor modifications in 2003 and 2007)

Note: No revisions or modifications since 2007 of any classification units according to the new USNVC hierarchy (FGDC, 2008) or according to Sawyer et al., 2009.

Each association name includes an author if the association was defined prior to this project. We were conservative about association names and retained original authors' names even if the type name does not follow Alliance name order. "[Provisional]" indicates newly defined types needing additional sampling; these types are also listed separately in Appendix L. An asterisk (*) following the name indicates it is a new association (or alliance) defined with data from this project. A plus symbol (+) following the name indicates the type requires further sampling for verification. Each association also includes a sample size based on the number of samples collected or analyzed for this report and used to develop the description. Sample plot numbers are indicated using the following formats: All 1998 and 1999 field data have a format such as "99K22" or "98M100" (for the year, collector's initial, and sequential number) and are listed first. NRI (1989-1993) data are listed second in regular font. Plots from the Wieslander (1935-1937) data set are listed third and are in bold, italic, underlined font, and plots from the Potter data set are always last in a list and are a 4-digit code in regular font such as "2045." The notation in brackets that there is no description indicates there is not a description provided in Appendix K, descriptions of vegetation associations, due to an insufficient number of samples among the data sets used for the classification. Nomenclature is that of the Integrated Taxonomic Information System (ITIS, www.itis.gov).

**I. Forest. Trees usually over five meters tall with their crowns interlocking (generally forming 60–100% cover).**

**I.A. Evergreen forest. Evergreen species generally contribute greater than 75 percent of the total tree cover.**

**I.A.6.N.b. Lowland or submontane winter–rain evergreen sclerophyllous forest**

I.A.6.N.b.2 *QUERCUS CHRYSOLEPIS* FOREST ALLIANCE

Canyon Live Oak-California Laurel Forest (*Quercus chrysolepis-Umbellularia californica* Forest)* (n=20) 98K13, 98M11, 98M19, 99K15, 99K50, 99K13, 99K22, 99K30, 321, 12, 22, 72, 144, 13, 14, 15, 42, 68, 71, 73, ***24, 418, 420, 687***

Canyon Live Oak/Whiteleaf Manzanita Forest (*Quercus chrysolepis/Arctostaphylos viscida* Forest)* (n=17) 98M2, 99K33, 99K35, 99K42, 99K11, 99K19, 315, 227, 320, 48, ***718, 434, 432, 152, 120, 253***

Canyon Live Oak/Greenleaf Manzanita Forest (*Quercus chrysolepis/Arctostaphylos patula* Forest)*+ (n=5) 20, 46, ***18, 38, 40***

Canyon Live Oak-Gray Pine Forest (*Quercus chrysolepis-Pinus sabiniana* Forest)*+ (n=8) 99K23, 99K51, ***544, 61, 122, 71, 118***

Canyon Live Oak-Ponderosa Pine Forest (*Quercus chrysolepis-Pinus ponderosa* Forest)*+ (n=3) *172*, 99K29, 99S22

Canyon Live Oak-Incense-cedar Forest (*Quercus chrysolepis-Calocedrus decurrens* Forest)*+ (n=3) 2, 3, 298

**I.A.8.N.a. Giant temperate or subpolar needle-leaved evergreen forest**

I.A.8.N.a.1 *SEQUOIADENDRON GIGANTEUM* FOREST ALLIANCE

Giant Sequoia-Sugar Pine/Pacific Dogwood Forest (*Sequoiadendron giganteum-Pinus lambertiana/Cornus nuttallii* Forest)* (n=11) ***754, 751, 753, 755,*** 98M67, 99S104, Potter 2035, 2033, 2034, 2037, 2032

**I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest**

I.A.8.N.b.4 *PINUS CONTORTA* FOREST ALLIANCE

Sierra Lodgepole Pine/Big Sagebrush Forest (*Pinus contorta* var. *murrayana/Artemisia tridentata* Forest) (Potter, 1998) (n=2) 98M53, 99K110

Sierra Lodgepole Pine Forest (*Pinus contorta* var. *murrayana* Forest) (Potter, 1998) (n=29) 98MCHS1, 289, 60, 112, ***560, 528, 532, 514, 516, 462, 465, 344, 360, 382, 317, 330, 241, 249, 254, 261, 236, 237, 238, 239, 169, 111, 25, 27, 366***

Sierra Lodgepole Pine/Western Labrador Tea Forest (*Pinus contorta* var. *murrayana/Ledum glandulosum* Forest) (Taylor, 1984) (n=6) 99K171, 99S168, 98K114, 99K141, ***486, 112***

Sierra Lodgepole Pine/Bog Blueberry Forest (*Pinus contorta* var. *murrayana*/*Vaccinium uliginosum* Forest)*+ (n= 4) 99K144, 99K164, 99S123, 99S169

Sierra Lodgepole Pine/Shorthair Sedge Woodland (*Pinus contorta* var. *murrayana/Carex exserta* Woodland)*+ (n=7) 98K111, 99K118, 99K122, 99S139, 231, ***579, 163***

Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest (*Pinus contorta* var. *murrayana-Pinus albicaulis/Carex rossii* Forest)* (n=32) 98M94, 167, 168, 215, 187, 113, 361, 345, 270, 300, 301, 290, 292, ***621, 275, 250, 19, 49, 149, 392, 287, 311, 263, 184, 186, 159, 153, 147, 105, 393, 273, 279***

Sierra Lodgepole Pine/Ross Sedge Forest (*Pinus contorta* var. *murrayana/Carex rossii* Forest)+ (Taylor, 1984) (n=4) *113*, 171, 176, 230

Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest (*Pinus contorta* var. *murrayana-Pinus albicaulis/Carex exserta* Forest [Provisional])*+ (n=2) 271, 173

Sierra Lodgepole Pine/Gray's Licorice-root [Gray's Lovage] Forest (*Pinus contorta* var. *murrayana/Ligusticum grayi* Forest) (Potter, 1998) (n=25) 189,

258, 11, 101, 190, 192, 193, 196, 340, 336, 109, 9, 108, ***79, 171, 155, 124, 119, 121, 8, 11, 162, 195, 708, 736***

Sierra Lodgepole Pine Woodland (*Pinus contorta* var. *murrayana* Woodland) (Potter, 1998) (n=22) 252, 185, 199, 253, 165, 360, 182, ***594, 533, 534, 522, 524, 398, 399, 400, 408, 334, 271, 272, 277, 103, 94***

Sierra Lodgepole Pine/Mountain Pride Woodland (*Pinus contorta* var. *murrayana*/*Penstemon newberryi* Woodland) (Taylor, 1984) (n=5) ***758, 740, 724, 617, 397*** (note this is actually sparse open woodland)

I.A.8.N.b.?? (NEW) *PINUS PONDEROSA-CALOCEDRUS DECURRENS* FOREST ALLIANCE

Ponderosa Pine-Incense-cedar-California Black Oak Forest (*Pinus ponderosa-Calocedrus decurrens-Quercus kelloggii* Forest)* (n=33) 98K23, 98K24, 98K31, 98K65, 98M16, 98M23, 98M25, 98M5, 98K16, 80, 82, 83, 316, 267, 268, 102, 103, 17, 23, ***540***, ***16***, ***445***, ***451***, ***452***, ***467***, ***474***, ***440***, ***57***, ***81***, ***116***, ***176***, ***46, 95***

Ponderosa Pine-Incense-cedar/Mountain Misery Forest (*Pinus ponderosa-Calocedrus decurrens/Chamaebatia foliolosa* Forest)*+ (n=6) 86, 264, ***299, 558, 705, 282***

Ponderosa Pine-Incense-cedar-Canyon Live Oak/Mountain Misery Forest (*Pinus ponderosa-Calocedrus decurrens-Quercus chrysolepis*/*Chamaebatia foliolosa* Forest) (after Fites, 1993) (n=5) 99K34, 99K46, 299, ***737, 438***

I.A.8.N.b.?? *ABIES CONCOLOR -PINUS LAMBERTIANA* FOREST ALLIANCE (NEW)

White Fir-Sugar Pine Forest (*Abies concolor-Pinus lambertiana* Forest)* (n=11) **173, 278, 284, 296**, **199, 428, 305, 306, 423, 424,** Potter 2022

White Fir-Sugar Pine/Whitethorn Ceanothus Forest (*Abies concolor-Pinus lambertiana/Ceanothus cordulatus* Forest)*+ (n=4) ***580, 303, 200, 56***

White Fir-Sugar Pine-Jeffrey Pine Forest (*Abies concolor-Pinus lambertiana-Pinus jeffreyi* Forest)* (n=19) ***774, 637, 460, 355, 316, 174, 160, 154, 448, 472, 479, 489, 733, 772, 723, 749, 639, 641, 170***

White Fir-Sugar Pine/False Solomon's-seal-Drops of Gold Forest (*Abies concolor-Pinus lambertiana/Maianthemum racemosum* [*Smilacina racemosa*, Hickman 1993]-*Disporum hookeri* Forest) (after Fites, 1993) (n=4) 135, 141, 279, ***301***

White Fir-Incense-cedar-Sugar Pine/Pacific Dogwood/California Hazel Forest (*Abies concolor-Calocedrus decurrens-Pinus lambertiana/Cornus nuttallii/Corylus cornuta* var. *californica* Forest) (after Fites, 1993) (n=6) 119, 133, ***257***, ***258***, ***539***, plus Potter 332

White Fir-Incense-cedar-Sugar Pine/American Trailplant Forest (*Abies concolor-Calocedrus decurrens-Pinus lambertiana/Adenocaulon bicolor* Forest) [after Fites, 1993] (n=7) 98K19, 99S105, 99S134, 98M69, 115, 117, 222

White Fir - Sugar Pine - Incense-cedar/Bush Chinquapin Forest (*Abies concolor-Pinus lambertiana-Calocedrus decurrens*/*Chrysolepis sempervirens* Forest) (after Fites, 1993) (n=13) 91, 327, 325, 326, 92, 98, ***661***, ***635***, ***313***, ***298***, ***34***, ***660***, ***443***

White Fir - Sugar Pine - Incense-cedar/Creeping Snowberry/Milky Kelloggia Forest (*Abies concolor-Pinus lambertiana-Calocedrus decurrens*/*Symphoricarpos mollis*/*Kelloggia galioides* Forest) [after Fites, 1993] (n=7) 88, 105, 116, 263, 314, 322, ***663***

I.A.8.N.c. Conical-crown temperate or subpolar needle-leaved evergreen forest

I.A.8.N.c.26 *ABIES MAGNIFICA* FOREST ALLIANCE

California Red Fir-Western White Pine/Bush Chinquapin Forest (*Abies magnifica-Pinus monticola/Chrysolepis sempervirens* Forest) (Potter, 1998) (n=5) 98K70, 98K67, 331, ***668, 338***

California Red Fir-Western White Pine Forest (*Abies magnifica-Pinus monticola* Forest) (Potter, 1998) (n=25) 98MCHS2, 124, 353, ***767, 752, 682, 686, 696, 604, 598, 485, 493, 515, 375, 367, 369, 340, 347, 363, 365, 244, 310, 78, 342***, Potter 2008

California Red Fir-Western White Pine/Pinemat Manzanita Forest (*Abies magnifica-Pinus monticola/ Arctostaphylos nevadensis* Forest) (Potter, 1998) (n=10) 99K112, 50, 226, 286, ***761, 673, 674, 670, 456***, Potter 2009

California Red Fir-Western White Pine/Huckleberry Oak Forest (*Abies magnifica-Pinus monticola/Quercus vaccinifolia* Forest [Provisional])+ (n=0) [Unsampled, but repeatedly seen along Tioga Road in Zone IV verification trip June 2002; no description provided due to lack of samples]

California Red Fir/Woolly Mule-ears Forest (*Abies magnifica/Wyethia mollis* Forest) (Potter, 1998) (n=0) [No samples, but occurs locally in northern Yosemite on volcanic lahars; no description provided due to lack of samples]

California Red Fir Forest (*Abies magnifica* Forest) (Potter, 1998) (n=37) 98K68, 94, 96, 121, 142, 272, 285, ***616, 618, 5, 657, 677, 678, 600, 602, 610, 548, 551, 562, 464, 484, 368, 343, 345, 312, 206, 222, 66, 185, 483, 494***, Potter 2012, 2013, 2016, 2017, 2002, 2010

California Red Fir/Pinemat Manzanita Forest (*Abies magnifica/Arctostaphylos nevadensis* Forest) (Potter, 1998) (n=5) ***590, 649, 651, 704, 592***

California Red Fir-Sierra Lodgepole Pine/Whiteflower Hawkweed Forest (*Abies magnifica-Pinus contorta* var. *murrayana/Hieracium albiflorum* Forest) (Potter, 1998) (n=19) 98MCHS5, 95, 97, 106, 125, 126, 127, 128, 188, 266, 339, ***605, 614, 629***, Potter 2005, 2004, 2014, 2003

California Red Fir-Western White Pine-Sierra Lodgepole Pine Forest (*Abies magnifica-Pinus monticola-Pinus contorta* var. *murrayana* Forest) (Potter, 1998) (n=30) 180, 194, 195, 129, 130, 337, 351, 59, 329, ***746, 620, 601, 531,***

***527, 521, 381, 388, 390, 370, 337, 318, 232, 220, 221, 211, 213, 107, 99, 9***, Potter 2006

I.A.8.N.c.?? *ABIES MAGNIFICA-ABIES CONCOLOR* FOREST ALLIANCE (Potter, 1998)

California Red Fir-White Fir-Jeffrey Pine Forest (*Abies magnifica-Abies concolor-Pinus jeffreyi* Forest) (Potter, 1998) (n=10) 98M65, 99K125, 90, 100, 275, ***54, 627, 51, 523***, Potter 2021

California Red Fir-White Fir Forest (*Abies magnifica-Abies concolor* Forest) (Potter, 1998) (n=23) ***599, 507, 458, 459, 356, 187, 203, 205, 53, 446, 427, 771, 552, 309, 319, 322, 327, 329, 189, 300, 325,*** Potter 653

White Fir-Sugar Pine-California Red Fir Forest (*Abies concolor-Pinus lambertiana- Abies magnifica* Forest) (Potter, 1998) (n=15) 98K59, 323, 343, 87, 89, 104, 120, 338, 342, ***179, 731, 546, 302, 177, 286***

I.A.8.N.c.?? *CALOCEDRUS DECURRENS* FOREST ALLIANCE

Incense Cedar-White Alder Forest (*Calocedrus decurrens-Alnus rhombifolia* Forest) (Potter, 2000 ms) (n=7) Potter 659, 649, 642, 662, 634, 635, 2030

I.A.8.N.c.22 PSEUDOTSUGA MENZIESII FOREST ALLIANCE

Douglas-Fir-White Fir-Incense-cedar Forest (*Pseudotsuga menziesii-Abies concolor-Calocedrus decurrens* Forest)+ (after Fites, 1993) (n=7) 99K47, 99S51, ***361, 407, 262, 134,*** Potter 660

Douglas-Fir-Canyon Live Oak Forest (Pseudotsuga menziesii-Quercus chrysolepis Forest) (Taylor & Teare, 1979) (n=10) 98M22, 34, 146, 147, 148, **437**, **449**, **450**, **453**, **354**

Douglas-Fir-White Alder Forest (*Pseudotsuga menziesii-Alnus rhombifolia* Forest)*+ (n=2) 98K35, 98M26 [a mapping unit only at this point; no description provided due to low sample size]

I.A.8.N.c.?? *PSEUDOTSUGA MENZIESII-PINUS PONDEROSA* FOREST ALLIANCE

Douglas-Fir-Ponderosa Pine-Incense-cedar Forest (*Pseudotsuga menziesii-Pinus ponderosa-Calocedrus decurrens* Forest)*+ (similar to Stuart et al., 1992) (n=5) 99S26, ***150***, ***144***, ***166***, ***175***

I.A.8.N.c.11 *TSUGA MERTENSIANA* FOREST ALLIANCE

Mountain Hemlock Forest (*Tsuga mertensiana* Forest) (Potter, 1998) (n=20) 99K117, 98K96, 98K101, 99S110, 159, 131, 122, ***630, 235, 593, 587, 23, 690, 585, 227, 131, 133, 41, 109, 333***

Mountain Hemlock-Western White Pine Forest (*Tsuga mertensiana-Pinus monticola* Forest) (n=19) (after Potter's *T. mertensiana*-steep, 1994) (n=4) 98K106, 99K145, 99K166, 287, ***108, 387, 615, 364, 658, 567, 225, 265, 331, 654, 650, 652, 760, 547, 549***

Mountain Hemlock-Sierra Lodgepole Pine Forest (*Tsuga mertensiana-Pinus contorta* var. *murrayana* Forest)* (n=33) 249, 201, 204, 197, ***609***, ***581***, ***545***, ***510***, ***470***, ***167***, ***135***, ***145***, ***117***, ***29***, ***648***, ***110***, ***35***, ***15,*** ***410***, ***141,*** ***607***, ***518***, ***535***, ***161***, ***638***, ***613***, ***589***, ***561***, ***563***, ***565***, ***569***, ***256***, Potter 1614

Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Forest (*Tsuga mertensiana-Pinus contorta var. murrayana-Pinus monticola* Forest) (Parker, 1988) (n=24) 208, ***7, 2, 734, 744, 577, 234, 240, 728, 730, 757, 759, 762, 591, 583, 395, 139, 233, 242, 82, 96, 619, 537***

**I.B. Deciduous forest. Deciduous tree species generally contribute greater than 75 percent of the total tree cover.**

**I.B.2.N.b. Montane or boreal cold-deciduous forest**

I.B.2.N.b.10 *POPULUS TREMULOIDES* FOREST ALLIANCE

Quaking Aspen/Big Sagebrush Forest (*Populus tremuloides/Artemisia tridentata* Forest [Provisional])*+ (n=5) 99S78, 99S83, 99S96, 98K48, 99K81

Quaking Aspen/Big Sagebrush/Mountain Monardella-Milky Kelloggia Forest (*Populus tremuloides*/*Artemisia tridentata*/*Monardella odoratissima-Kelloggia galioides* Forest [Provisional])*+ (n=6) (close to Potter's 1998 Populus tremuloides/Monardella odoratissima) 99K98, 99K77, 99S122, 99K97, 99S61, ***511***

Quaking Aspen/Mountain Monardella Forest (*Populus tremuloides*/*Monardella odoratissima* Forest) (Potter, 1998) (n=2) 99S144, 98K50

Quaking Aspen-Jeffrey Pine Forest (*Populus tremuloides-Pinus jeffreyi* Forest)*+ (n=7) 98M58, 98M46, 98K56, 98M56, 99S86, ***92***, ***198***

Quaking Aspen/Kentucky Bluegrass Forest (*Populus tremuloides/Poa pratensis* Forest [Provisional])*+ (n=1) 99S60

Quaking Aspen/Woods' Rose Forest (Populus tremuloides/Rosa woodsii Forest [Provisional])*+ (n=6) 98K46, 99K54, 99K86, 99K93, 99S57, 99S64

Quaking Aspen/California False Hellebore Forest (*Populus tremuloides/Veratrum californicum* Forest) (Potter, 1998) (n=8) 99S106, 98K115, 99S167, 99K128, 18, 19, 37, ***712***

Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest (*Populus tremuloides-Pinus contorta* var. *murrayana*/*Artemisia tridentata*/*Poa pratensis* Forest)*+ (n=4) 99S65, 99K57, 99K84, 99K85, 98M52

I.B.2.N.b.?? *QUERCUS KELLOGGII* FOREST ALLIANCE (NEW PROVISIONAL)*+ (n=3) 98K17, 99S21, **541**

California Black Oak/Mewuk Manzanita-Mountain Misery Forest (*Quercus kelloggii/Arctostaphylos mewukka-Chamaebatia foliolosa* Forest [Provisional])*+ (n=4) 99S23, 99S25, 99S37, ***717***

California Black Oak/Greenleaf Manzanita Forest (*Quercus kelloggii/Arctostaphylos patula* Forest) (Allen et al., 1991) (n=5) 99K39, 150, ***181, 572, 586***

California Black Oak-Incense Cedar Forest (*Quercus kelloggii-Calocedrus decurrens* Forest [Provisional])*+ (n=9) 10, 41, 149, 265, 25, 70, 99S29, 99S36, 98M20

**I.B.2.N.d. Temporarily flooded cold-deciduous forest**

I.B.2.N.d.31 *ALNUS RHOMBIFOLIA* TEMPORARILY FLOODED FOREST ALLIANCE

White Alder Forest (*Alnus rhombifolia* Forest) [Potter, 2000 ms] (n=5) 98M37, 99K28, 99K40, 98M30, Potter 661

I.B.2.N.d.36 *POPULUS BALSAMIFERA* SSP. *TRICHOCARPA* TEMPORARILY FLOODED FOREST ALLIANCE

Black Cottonwood-Jeffrey Pine Forest (*Populus balsamifera* ssp. *trichocarpa-Pinus jeffreyi* Forest [Provisional])*+ (n=3) 98M55, 98M49, 98M50

Black Cottonwood/(Western Azalea) Forest (*Populus balsamifera* ssp. *trichocarpa/*(*Rhododendron occidentale*) Forest [Provisional])*+ (n=2) 99S49, 99K49

I.B.2.N.d.38 *POPULUS FREMONTII* TEMPORARILY FLOODED FOREST ALLIANCE

Fremont Cottonwood Stands: limited to far eastern portion of mapping area in western Mono Basin; (n=0) [new alliance observed during this project; no description provided due to lack of samples]

**I.B.2.N.e. Seasonally flooded cold-deciduous forest**

I.B.2.N.e.28 *FRAXINUS LATIFOLIA* SEASONALLY FLOODED FOREST ALLIANCE [Provisional]+ (defined by Potter, 2000 ms plots) (n=2) 99S41, 99S40

**II. Woodland. Open stands of trees usually over five meters tall with crowns not usually touching (generally forming 25–60 percent cover).**

**II.A. Evergreen woodland. Evergreen species generally contribute greater than 75 percent of the total tree cover.**

**II.A.4.N.a. Rounded-crowned temperate or subpolar needle-leaved evergreen woodland**

II.A.4.N.a.37 *JUNIPERUS OCCIDENTALIS ssp. AUSTRALIS* WOODLAND ALLIANCE

Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland (*Juniperus occidentalis* ssp. *australis-Cercocarpus ledifolius/Artemisia tridentata* Woodland [Provisional])*+ (n=4) 99K96, 99S73, 99S93, 98M51

Sierra Juniper/Big Sagebrush Woodland (*Juniperus occidentalis* ssp. *australis/Artemisia tridentata* Woodland) (Potter, 1998) (n=6) 99S146, 99K90, 99S147, ***165***, ***289***, ***480***

Sierra Juniper Woodland (*Juniperus occidentalis* ssp. *australis* Woodland) (Potter, 1998) (n=38) 98M107, 98M86, 98MCHS6, 98MCHS7, 169, 236, 247,

229, 246, 334, 359, 191, 241, 248, ***102, 91, 100, 77, 86, 101, 389, 688, 750, 74, 76, 80, 104, 212, 224, 336, 339, 612, 666, 702, 710, 13, 385, 374***

Sierra Juniper/Oceanspray Woodland (*Juniperus occidentalis* ssp. *australis/Holodiscus discolor* Woodland) (n=5) **31**, **37**, **126**, **623**, **646** (This is considered a phase of the Sierra juniper Woodland [*Juniperus occidentalis* ssp. *australis* Woodland]) (Potter, 1998)

Sierra Juniper/Pinemat Manzanita Woodland (*Juniperus occidentalis ssp. australis/Arctostaphylos nevadensis* Woodland) (n=3) ***394***, ***732***, ***742*** (This is a phase of Sierra juniper Woodland [*Juniperus occidentalis* ssp. *australis* Woodland]) (Potter, 1998)

II.A.4.N.a.33 *PINUS ALBICAULIS* WOODLAND ALLIANCE

Whitebark Pine-Mountain Hemlock Woodland *(Pinus albicaulis-Tsuga mertensiana* Woodland)* (n=28) 99K131, 99S153, 99S98, 99K132, 358, 356, 170, 303, 206, 304, 250, ***611***, ***3***, ***626***, ***39***, ***406***, ***512***, ***85***, ***87***, ***106***, ***137***, ***624***, ***634***, ***571***, ***632***, ***378***, ***143***, ***281***

Whitebark Pine/Shorthair Sedge Woodland (*Pinus albicaulis/Carex exserta* Woodland)* (n=10) 98K123, 98M113, 79, 160, 232, 245, 256, 262, 310, ***252***

Whitebark Pine/Davidson's Penstemon Woodland (*Pinus albicaulis/*(*Penstemon davidsonii*) Woodland [Provisional])+ (Taylor, 1984) (n=2) 309, ***373***

Whitebark Pine/Ross Sedge Woodland (*Pinus albicaulis/Carex rossii* Woodland [Provisional])*+ (n=5) 200, 243, 346, 347, 349 [Includes the Whitebark Pine/Wheeler Bluegrass Woodland (*Pinus albicaulis/Poa wheeleri* Woodland) of Taylor (1984)]

II.A.4.N.a.10 *PINUS ATTENUATA* WOODLAND ALLIANCE

Knobcone Pine/Chamise Woodland (*Pinus attenuata/Adenostoma fasciculatum* Woodland [Provisional]) (n=0) [A mapping unit only at this time, requires sampling for verification as an association; no description provided due to lack of samples.]

Knobcone Pine-Canyon Live Oak Woodland (*Pinus attenuata-Quercus chrysolepis* Woodland [Provisional]) (n=0) [A mapping unit only at this time; requires sampling for verification as an association; no description provided due to lack of samples.]

Knobcone Pine/Whiteleaf Manzanita Woodland (*Pinus attenuata/Arctostaphylos viscida* Woodland [Provisional])*+ (n=3) 99S10, 99S32, 98M6

II.A.4.N.a.42 *PINUS FLEXILIS* WOODLAND ALLIANCE (observed on east slope, n=0) [new provisional alliance; no description provided due to lack of samples]

II.A.4.N.a.43 *PINUS JEFFREYI* WOODLAND ALLIANCE

Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland (*Pinus jeffreyi-Cercocarpus ledifolius* Woodland)*+ (n=5) 99K129, 99K76, 99K82, 99S80, 99S77

Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland (*Pinus jeffreyi-Quercus chrysolepis/ Arctostaphylos viscida* Woodland)*+ (n=5) 319, ***69, 44, 47, 58***

Jeffrey Pine-Singleleaf Pinyon Pine Woodland (*Pinus jeffreyi-Pinus monophylla* Woodland)*+ (n=3) 99K94, 99S100, 99K58

Jeffrey Pine-White Fir/Round-leaved Snowberry/Squirreltail Woodland (*Pinus jeffreyi-Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland [Provisional])*+ (n=3) 99K75, 99S75, 99S95

Jeffrey Pine/Antelope Bitterbrush Woodland (*Pinus jeffreyi/Purshia tridentata* Woodland) (Taylor, 1980) (n=4) 98M59, 98K47, 98M38, 99S56

Jeffrey Pine/Bush Chinquapin Woodland (*Pinus jeffreyi/Chrysolepis sempervirens* Woodland) (Talley, 1978) (n=4) 98M62, ***359, 384, 201***

Jeffrey Pine/Huckleberry Oak Woodland (*Pinus jeffreyi/Quercus vaccinifolia* Woodland) (Potter, 1998) (n=24) 98MCHS4, 281, 52, 30, 223, ***455, 490, 492, 499, 502, 631, 655, 659, 386, 431, 219, 473, 770, 675, 676, 700, 625, 487***, Potter 2018

Jeffrey Pine/Whitethorn Ceanothus Woodland (*Pinus jeffreyi/Ceanothus cordulatus* Woodland)+ (Potter, 1998) (n=3) 99K106, 350, 57 Potter 2501

Jeffrey Pine-California Red Fir Woodland (*Pinus jeffreyi-Abies magnifica* Woodland) (Potter, 1998) (n=15) 269, ***341, 350, 379, 463, 653, 680, 191, 65, 633, 348, 679, 497, 377, 358***

Jeffrey Pine-White Fir Woodland (*Pinus jeffreyi-Abies concolor* Woodland)* (n=39) 21, 28, 38, 58, 164, 24, 51, 93, ***349, 12, 335, 647, 357, 500, 503, 504, 506, 508, 509, 519, 568, 595, 469, 478, 491, 380, 383, 376, 245, 246, 247, 332, 352, 353, 93, 471, 472, 475, 471***

Jeffrey Pine/Greenleaf Manzanita Woodland (*Pinus jeffreyi/Arctostaphylos patula* Woodland) (Potter, 1998) (n=18) 36, 45, 47, 56, 228, ***208, 550, 584, 501, 73, 156, 60, 576, 62, 216, 297, 193***

II.A.4.N.a.45 *PINUS MONOPHYLLA* WOODLAND ALLIANCE

Singleleaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big Sagebrush-Antelope Bitterbrush Woodland (*Pinus monophylla-Cercocarpus ledifolius/Artemisia tridentata-Purshia tridentata* Woodland [Provisional])*+ (n=4) 98K43, 99S68, 99S88, 99S89

Singleleaf Pinyon Pine/Desert Gooseberry Woodland (*Pinus monophylla/Ribes velutinum* Woodland [Provisional])*+ (n=9) 98K44, 98M39, 98M45, 99K55, 99K56, 99K59, 99K61, 99K63, 99K87

Singleleaf Pinyon Pine/Big Sagebrush/Squirreltail Woodland (*Pinus monophylla*/*Artemisia tridentata/Elymus elymoides* Woodland [Provisional])*+ (n=2) 99S91, 99S92

II.A.4.N.a.34 *PINUS MONTICOLA* WOODLAND ALLIANCE

Western White Pine-Sierra Lodgepole Pine/Western Needlegrass Woodland (*Pinus monticola-Pinus contorta var. murrayana/Achnatherum occidentale* Woodland [Provisional])* (n=30) 98K53, 99K108, 99K126, 77, 110, 172, 178, 209, 210, 211, 261, 330, ***768, 764, 671, 603, 269, 230, 89, 391, 529, 575, 267, 371, 372, 90, 217, 226, 326***, Potter 2026

II.A.4.N.a.32 *PINUS PONDEROSA* WOODLAND ALLIANCE

Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland (*Pinus ponderosa-Quercus kelloggii/Arctostaphylos viscida* Woodland [Provisional])*+ (n=5) 98M10, 98M9, 99K20, 318, ***681***

II.A.4.N.a.27 *PINUS SABINIANA* WOODLAND ALLIANCE

Gray Pine/Buckbrush/Grass Woodland (*Pinus sabiniana/Ceanothus cuneatus*/grass Woodland [Provisional])*+ (n=1) 99S3 [no description]

Gray Pine-Interior Live Oak/Buckbrush Woodland (*Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* Woodland [Provisional])*+ (n=4) 98K8, 99K43, 99K8, 99S5

Gray Pine-Interior Live Oak/Chamise Woodland (*Pinus sabiniana-Quercus wislizeni*/*Adenostoma fasciculatum* Woodland [Provisional])*+ (n=0) [new provisional association; no description provided due to lack of samples]

Gray Pine-Interior Live Oak/Whiteleaf manzanita Woodland (*Pinus sabiniana-Quercus wislizeni*/*Arctostaphylos viscida* Woodland [Provisional])*+ (n=4) 99S16, 99K41, 54, 55

**II.A.5.N.a. Sclerophyllous extremely xeromorphic evergreen woodland**

II.A.5.N.a.1 *CERCOCARPUS LEDIFOLIUS* WOODLAND ALLIANCE

Curl-leaf Mountain Mahogany/Roundleaf Snowberry Woodland (*Cercocarpus ledifolius/Symphoricarpos rotundifolius* Woodland)*+ (n=8) 99K65, 99K66, 99K69, 99K70, 99S90, 99S97, 99S99, 99S81

II.A.5.N.a.6 *QUERCUS WISLIZENI* WOODLAND ALLIANCE

Interior Live Oak-Canyon Live Oak Woodland (*Quercus wislizeni-Quercus chrysolepis* Woodland [Provisional])*+ (n=3) 99S8, 98M1, Potter 1238

Interior Live Oak/Whiteleaf Manzanita Woodland (*Quercus wislizeni/Arctostaphylos viscida* Woodland [Provisional])+ (Allen et al., 1991) (n=2) 99K24, **416**

Interior Live Oak-Blue Oak-Gray Pine/Brome Species-American Wild Carrot Woodland (*Quercus wislizeni-Quercus douglasii-Pinus sabiniana/Bromus* spp.-*Daucus pusillus* Woodland) (Allen et al., 1991) (n=2) 99K1, 98K1

**II.B. Deciduous woodland. Deciduous tree species generally contribute greater than 75 percent of the total tree cover**

**II.B.2.N.a. Cold-deciduous woodland**

II.B.2.N.a.2 *AESCULUS CALIFORNICA* WOODLAND ALLIANCE

California Buckeye/Silver Lupine Woodland (*Aesculus californica/Lupinus albifrons* Woodland [Provisional])*+ (n=1) 99S7 [no description]

California Buckeye/Durango Root Woodland (*Aesculus californica/Datisca glomerata* Woodland [Provisional])*+ (n=1) 99S44 [no description]

II.B.2.N.a.14 *QUERCUS DOUGLASII* WOODLAND ALLIANCE

Blue Oak/Buckbrush/Annual Grass Woodland (*Quercus douglasii/Ceanothus cuneatus* /Poaceae Woodland) (Allen et al., 1991) (n=1) 99S35

Blue Oak/Brome Species-American Wild Carrot Woodland (*Quercus douglasii/Bromus* spp.-*Daucus pusillus* Woodland [Provisional])+ (n=5) 99S20, 98K10, 98K15, 98K22, 99K16 (equivalent to Allen et al., 1991 blue oak/grass subseries)

Blue Oak-Gray Pine/Grass Woodland (*Quercus douglasii-Pinus sabiniana*/Grass Woodland) (Allen et al., 1991) (n=2) 99K18, 99K2

Blue Oak-Interior Live Oak/Brome Species-American Wild Carrot Woodland (*Quercus douglasii-Quercus wislizeni/Bromus* spp.-*Daucus pusillus* Woodland (Allen et al., 1991) (n=6) 99S12, 99S13, 99S15, 99S34, 99K3, 98M12

II.B.2.N.a.18 *QUERCUS LOBATA* WOODLAND ALLIANCE (Allen et al., 1991) (n=3) 98K9, 99S4, 99S18 [insufficient number of stands in the study area to define associations]

**II.B.2.N.b. Temporarily flooded cold-deciduous woodland**

II.B.2.N.b.14 *SALIX LAEVIGATA* TEMPORARILY FLOODED WOODLAND ALLIANCE [Provisional]*+ (n=2) 99S42, 99S39

**III. Shrubland. Shrubs or trees usually 0.5 to five meters tall with individuals or clumps not touching to interlocking (generally forming greater than 25 percent canopy cover).**

**III.A. Evergreen shrubland. Evergreen species generally contribute greater than 75 percent of the total shrub and/or tree cover.**

**III.A.2.N.a Temperate broad-leaved evergreen shrubland**

III.A.2.N.a.?? *LUPINUS ALBIFRONS* SHRUBLAND ALLIANCE [Provisional]*+

Silver Lupine Shrubland (*Lupinus albifrons* Shrubland [Provisional])*+ (n=3) 99K44, 99S53, 99S54

**III.A.2.N.c. Sclerophyllous temperate broad-leaved evergreen shrubland**

III.A.2.N.c.2 *ADENOSTOMA FASCICULATUM* SHRUBLAND ALLIANCE

Chamise-Whiteleaf Manzanita Shrubland (*Adenostoma fasciculatum-Arctostaphylos viscida* Shrubland [Provisional])*+ (n=2) 99S31, 99S9 [no description]

Chamise Shrubland (*Adenostoma fasciculatum* Shrubland [Provisional])*+ (n=5) 98K6, 99K17, 98K20, 99S2, 99S6

III.A.2.N.c ?? *ADENOSTOMA FASCICULATUM - CEANOTHUS CUNEATUS* SHRUBLAND ALLIANCE (Gordon & White 1994)

Chamise-Buckbrush Shrubland (*Adenostoma fasciculatum-Ceanothus cuneatus* Shrubland [Provisional])*+ (n=5) 98M14, 99K10, 99K14, 99K9, ***417***

III.A.2.N.c.35 *ARCTOSTAPHYLOS PATULA* SHRUBLAND ALLIANCE

Greenleaf Manzanita Shrubland (*Arctostaphylos patula* Shrubland)* (n=17) 98M68, 98M73, 99K26, 276, ***513, 517, 293, 769, 578, 570, 403, 695, 304, 292, 264, 207, 307***

III.A.2.N.c.37 *ARCTOSTAPHYLOS VISCIDA* SHRUBLAND ALLIANCE

Whiteleaf Manzanita Shrubland (*Arctostaphylos viscida* Shrubland)* (n=10) 98K21, 98K63, 99S27, 98K32, 98M8, 99K21, 99S24, 99S28, 98K18, 4

III.A.2.N.c.9 *CHRYSOLEPIS SEMPERVIRENS* SHRUBLAND ALLIANCE

Bush Chinquapin Shrubland (*Chrysolepis sempervirens* Shrubland)*+ (n=7) 98K60, 99S166, 98K126, 99K116, 99S116, ***243, 29***

III.A.2.N.c.10 *CEANOTHUS CORDULATUS* SHRUBLAND ALLIANCE

Whitethorn Ceanothus Shrubland (*Ceanothus cordulatus* Shrubland)* (n=13) 98M70, 98K58, 98K62, 348, ***588***, ***582***, ***727***, ***554***, ***553***, ***574***, ***405***, ***711***, ***288***

III.A.2.N.c.12 *CEANOTHUS CUNEATUS* SHRUBLAND ALLIANCE

Buckbrush/Brome Species Shrubland (*Ceanothus cuneatus*/*Bromus* spp. Shrubland [Provisional])*+ (n=5) 99S11, 99K37, 44, ***411***, ***425***

III.A.2.N.c.14 *CEANOTHUS LEUCODERMIS* SHRUBLAND ALLIANCE*+

Chaparral Whitethorn/Poison Oak Shrubland (*Ceanothus leucodermis/Toxicodendron diversilobum* Shrubland [Provisional])*+ (n=2) 99S43, 98K7 [no description]

III.A.2.N.c.31 *QUERCUS VACCINIFOLIA* SHRUBLAND ALLIANCE*+ (n=0)

Huckleberry Oak Shrubland (*Quercus vaccinifolia* Shrubland [Provisional])*+ (n=2) 235, 280 [no description]

Huckleberry Oak-Bush Chinquapin Shrubland (*Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland [Provisional])*+ (n=4) 98K113, ***468, 488, 496***

Huckleberry Oak-Greenleaf Manzanita Shrubland (*Quercus vaccinifolia-Arctostaphylos patula* Shrubland) (Sawyer & Thornburgh, 1971) (n=10) 98K104, ***447, 703, 495, 10, 64, 67, 84, 97, 351***

III.A.2.N.c.34 *CEANOTHUS VELUTINUS* SHRUBLAND ALLIANCE

Snowbrush Ceanothus-Bitter Cherry-Big Sagebrush Shrubland (*Ceanothus velutinus-Prunus emarginata-Artemisia tridentata* Shrubland [Provisional])*+ (n=6) 99K67, 99K74, 99K79, 98M54, 99S66, 99S70

III.A.2.N.c.33 *QUERCUS WISLIZENI* SHRUBLAND ALLIANCE+ (n=2) 99S14, 98K3 [no associations defined due to insufficient samples]

**III.A.4.N.a. Microphyllous evergreen shrubland**

III.A.4.N.a.15 *ARTEMISIA CANA* SHRUBLAND ALLIANCE

Silver Sagebrush/Missouri Iris-Baltic Rush Shrubland (*Artemisia cana/Iris missouriensis-Juncus balticus* Shrubland [Provisional])*+ (n=2) 99K88, 99S94

III.A.4.N.a.19 *ARTEMISIA TRIDENTATA* SSP. *VASEYANA* SHRUBLAND ALLIANCE

Mountain Big Sagebrush/Shorthair Sedge Shrubland (*Artemisia tridentata* ssp. *vaseyana/Carex exserta* Shrubland [Provisional])*+ (n=3) 98M89, 35, 233

Mountain Big Sagebrush/Mountain Monardella Shrubland (*Artemisia tridentata* ssp. *vaseyana/Monardella odoratissima* Shrubland [Provisional])*+ (n=3) 53, 225, 259

III.A.4.N.a.17 *ARTEMISIA TRIDENTATA* SHRUBLAND ALLIANCE*+ (n=0)

Big Sagebrush-Rubber Rabbitbrush Shrubland (*Artemisia tridentata* ssp. *tridentata-Ericameria nauseosa* Shrubland [Provisional])*+ (n=1) 99K62 [no description]

Big Sagebrush/Indian Ricegrass Shrubland (*Artemisia tridentata* spp. *tridentata/Achnatherum hymenoides* Shrubland [Provisional])*+ (n=2) 99S72, 99S79

III.A.4.N.a.13 *PURSHIA TRIDENTATA* SHRUBLAND ALLIANCE

Antelope Bitterbrush-Big Sagebrush-Spineless Horsebrush Shrubland (*Purshia tridentata-Artemisia tridentata-Tetradymia canescens* Shrubland [Provisional])*+ (n=7) 98K38, 98K45, 99S82, 99S62, 99S63, 99S76, 99S87

Antelope Bitterbrush-Big Sagebrush/Indian Ricegrass Shrubland (*Purshia tridentata-Artemisia tridentata/Achnatherum hymenoide*s Shrubland [Provisional])*+ (n=4) 98K37, 98M40, 98M42, 99K60

Antelope Bitterbrush-Big Sagebrush/Nevada Needlegrass-(Dore's Needlegrass) Shrubland (*Purshia tridentata-Artemisia tridentata/Achnatherum nevadense-(Achnatherum nelsonii* ssp. *dorei*) Shrubland [Provisional])*+ (n=3) 99K71, 99K72, 99K73

Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Shrubland (*Purshia tridentata-Artemisia tridentata-Symphoricarpos rotundifolius* Shrubland [Provisional])*+ (n=5) 98K42, 98K79, 99K80, 99S58, 99S59

**III.B. Deciduous shrubland. Deciduous species generally contribute greater than 75 percent of the total shrub and/or tree cover.**

**III.B.2.N.a. Temperate cold-deciduous shrubland**

III.B.2.N.a.1 *CERCOCARPUS MONTANUS* VAR. *GLABER* [*C. betuloides var. betuloides*, Hickman, 1993] SHRUBLAND ALLIANCE

Birchleaf Mountain Mahogany Sierran Chaparral Shrubland (*Cercocarpus montanus* var. *glaber* [*C. betuloides* var. *betuloides*, Hickman 1993] Sierran Chaparral Shrubland [Provisional])*+ (n=5) 98M17, 99K53, 98K12, 99K12, ***721***

III.B.2.N.a.2 *CEANOTHUS INTEGERRIMUS* SHRUBLAND ALLIANCE*+ (n=0)

Deerbrush-Whiteleaf Manzanita-(Indian Manzanita) Shrubland (*Ceanothus integerrimus-Arctostaphylos viscida-* (*Arctostaphylos mewukka*) Shrubland [Provisional])*+ (n=2) 99K27, 99S47

Deerbrush-Whitethorn Ceanothus Stands (*Ceanothus integerrimus-Ceanothus cordulatus* Stands [Provisional])+ (n=2) 99S48, ***719*** [no description]

III.B.2.N.a.8 *HOLODISCUS DISCOLOR* SHRUBLAND ALLIANCE

Oceanspray-European Red Elderberry Shrubland (*Holodiscus discolor-Sambucus racemosa* Shrubland [Provisional])*+ (n=1) 98K107 [no description]

Oceanspray/Sierra Stonecrop-Parsley Fern Shrubland (*Holodiscus discolor/Sedum obsusatum* ssp. *boreale-Cryptogramma acrostichoides* Shrubland [Provisional])*+ (n=4) 99K109, 99K172, 99S161, 98K99

III.B.2.N.a ?? *PRUNUS EMARGINATA* SHRUBLAND ALLIANCE (NEW)

Bitter Cherry Shrubland (*Prunus emarginata* Shrubland [Provisional])*+ (n=3) 99K105, 98M104, 98M47

III.B.2.N.a.12 *QUERCUS GARRYANA* SHRUBLAND ALLIANCE*+ (n=1) 99K7 [observed in the Merced River Canyon]

**III.B.2.N.d. Temporarily flooded cold-deciduous shrubland**

III.B.2.N.d.6 *SALIX EXIGUA* TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Narrow-leaf Willow/Rush Shrubland (*Salix exigua/Juncus* spp. Shrubland [Provisional])*+ (n=2) 98K40, 98K49

III.B.2.N.d.36 *SALIX LASIOLEPIS* TEMPORARILY FLOODED SHRUBLAND ALLIANCE (n=1) 98M13

Arroyo Willow-Canyon Live Oak/Spice Bush Shrubland (*Salix lasiolepis-Quercus chrysolepis/Calycanthus occidentalis* Shrubland [Provisional])*+ (n=1) 332 [no description]

**III.B.2.N.e. Seasonally flooded cold-deciduous shrubland**

III.B.2.N.e.20 *SALIX EASTWOODIAE* SEASONALLY FLOODED SHRUBLAND ALLIANCE

Eastwood's Willow Shrubland (*Salix eastwoodiae* Shrubland)* (n=10) 32, 33, 76, Potter 1035, 1007, 1509, 1719, 1028, 1004, 1646

III.B.2.N.e?? *SALIX LEMMONII* SHRUBLAND ALLIANCE (NEW)

Lemmon's Willow Shrubland (*Salix lemmonii* Shrubland [Provisional])*+ (n=3) 98M108, 99K124, 99S142 (Potter, 2000 ms)

III.B.2.N.e?? *SALIX MELANOPSIS* SEASONALLY FLOODED SHRUBLAND ALLIANCE

Dusky Willow Shrubland (*Salix melanopsis* Shrubland [Provisional])*+ (n=3) Potter 1568, 1566, 1567

III.B.2.N.e ?? *SALIX ORESTERA/ALLIUM VALIDUM* SEASONALLY FLOODED SHRUBLAND ALLIANCE (Taylor, 1984)

Sierra Willow/Swamp Onion Shrubland (*Salix orestera/Allium validum* Shrubland) (Taylor, 1984) (n=1) 98M91 [no description]

Sierra Willow/Arrowleaf Groundsel Shrubland (*Salix orestera/Senecio triangularis* Shrubland) (Taylor, 1984 and Major & Taylor, 1977) (n=3) 98M116, 98M96, Potter 1619

Sierra Willow/Shorthair Reedgrass Shrubland (*Salix orestera/Calamagrostis breweri* Shrubland) (Taylor, 1984) (n=3) 99S159, Potter 1563, 1620

III.B.2.N.e.23 *SALIX PLANIFOLIA* SEASONALLY FLOODED SHRUBLAND ALLIANCE

Tea-leaf Willow Shrubland (*Salix planifolia* Shrubland [Provisional])*+ (n=6) 98M83, 98M118 Potter 1565, 1617, 1016, 1017 [no description, Potter samples not available]

Tea-leaf Willow/Rocky Mountain Sedge Shrubland (*Salix planifolia/Carex scopulorum* Shrubland) (Taylor, 1984) (n=1) 98K119

**IV. Dwarf-shrubland. Low-growing shrubs and/or trees usually under 0.5 meter tall, individuals or clumps not touching to interlocking (generally forming greater than 25 percent cover).**

**IV.A. Evergreen dwarf-shrubland. Evergreen species generally contribute greater than 75 percent of the total dwarf-shrub and/or tree cover.**

**IV.A.1.N.a. Caespitose needle-leaved or microphyllous evergreen dwarf-shrubland**

IV.A.1.N.a.13 *ARTEMISIA ARBUSCULA* DWARF-SHRUBLAND ALLIANCE*+ (n=1) 99S125

Low Sagebrush/Prickly Phlox Dwarf-shrubland (*Artemisia arbuscula/Leptodactylon pungens* Dwarf-shrubland [Provisional])*+ (n=4) 98K54, 98M111, 98M80, 99K64

Low Sagebrush/Slender Buckwheat Dwarf-shrubland (*Artemisia arbuscula/Eriogonum microthecum* Dwarf-shrubland [Provisional])*+ (n=3) 99K91, 99K92, 99S67

IV.A.2.N.a.2 *ARTEMISIA ROTHROCKII* DWARF-SHRUBLAND ALLIANCE

Timberline Sagebrush/Mountain Monardella Dwarf-shrubland (*Artemisia rothrockii/Monardella odoratissima* Dwarf-shrubland) (Taylor, 1984) (n=6) 99S126, 99S128, 98M74, ***665, 667, 259***

IV.A.1.N.a.?? *CHAMAEBATIA FOLIOLOSA* DWARF-SHRUBLAND ALLIANCE (PROVISIONAL)

Mountain Misery-Whiteleaf Manzanita Dwarf-shrubland (*Chamaebatia foliolosa- Arctostaphylos viscida* Dwarf-shrubland [Provisional])*+ (n=4) 99K25, 99K31, 99S38, ***739***

**IV.B. Deciduous dwarf-shrubland. Deciduous species generally contribute greater than 75 percent of the total dwarf-shrub and/or tree cover.**

**IV.B.2.N.a. Caespitose cold-deciduous dwarf-shrubland**

IV.B.2.N.a.2 *VACCINIUM* (*CAESPITOSUM, SCOPARIUM*) DWARF-SHRUBLAND ALLIANCE

Sierra Bilberry/Shorthair Sedge Dwarf-Shrubland (*Vaccinium caespitosum/Carex exserta* Dwarf-Shrubland [Provisional])*+ (n=4) 98M99, 99K148, Potter 1669, 1648

**IV.B.2.N.b. Creeping or matted cold-deciduous dwarf-shrubland**

IV.B.2.N.b.2 *SALIX ARCTICA* DWARF-SHRUBLAND ALLIANCE

Arctic Willow-Shorthair Reedgrass-Sierra Bilberry-Pussytoes Dwarf-shrubland (*Salix arctica-Calamagrostis breweri-Vaccinium caespitosum-Antennaria media* Dwarf-shrubland)* (similar to Taylor 1984) (n=9) 98K91, 98M114, 98M129, 98M92, 99K155, 99S140, 99S156, 99S160, 98M130

IV.B.2.N.b.4 *SALIX* (*RETICULATA, NIVALIS*) DWARF-SHRUBLAND ALLIANCE+ Snow willow alliance only (n=1) 99S157

**IV.B.2.N.d. Saturated cold-deciduous dwarf-shrubland**

IV.B.2.N.d.2 *VACCINIUM ULIGINOSUM* SATURATED DWARF-SHRUBLAND ALLIANCE

Bog Blueberry Dwarf-shrubland (*Vaccinium uliginosum* Dwarf-shrubland)*+ (n=3) Potter 1610, 1034, 1721

**V. Herbaceous vegetation. Graminoids and/or forbs (including ferns) generally form greater than 10 percent cover with woody cover usually less than 10 percent.**

**V.A. Perennial graminoid vegetation. Graminoids over one meter tall when inflorescences are fully developed, generally contributing to greater than 50 percent of total herbaceous cover.**

**V.A.5.N.d. Medium-tall bunch temperate or subpolar grassland**

V.A.5.N.d.?? *ELYMUS GLAUCUS* HERBACEOUS ALLIANCE (PROVISIONAL)*+(n=0)

Blue Wildrye Herbaceous Vegetation (*Elymus glaucus* Herbaceous Vegetation [Provisional])*+ (n=1) 99K114 [no description]

Blue Wildrye-Wooly Sedge Herbaceous Vegetation (*Elymus glaucus*-*Carex pellita* [*Carex lanuginosa*, Hickman 1993]) Herbaceous Vegetation [Provisional])*+ (n=4) 98K34, 98M32, 98K28, 98K29

Blue Wildrye-Greensheath Sedge Herbaceous Vegetation (*Elymus glaucus*-*Carex feta* Herbaceous Vegetation [Provisional])*+ (n=3) 98K33, 98K36, 98M48

**V.A.5.N.g. Short alpine or subalpine sod grassland**

V.A.5.N.g.1 *CALAMAGROSTIS BREWERI* HERBACEOUS ALLIANCE

Shorthair Reedgrass-Bilberry Herbaceous Vegetation (*Calamagrostis breweri*-*Vaccinium caespitosum* Herbaceous Vegetation) (Taylor, 1984) (n=13) 98K81, 98K86, 98M117, 98M128, 161, 49, 67, 69, 152, 153, 154, 155, 156

Shorthair Reedgrass-Alpine Aster Herbaceous Vegetation (*Calamagrostis breweri*-*Oreostemma alpigenum var. andersonii* [*Aster alpigenus* var. *andersonii*, Hickman 1993]) Herbaceous Vegetation [Provisional])*+ (n=5) 98K75, 98M76, 99K159, 99K167, 99K168

Shorthair Reedgrass-Spike Trisetum Herbaceous Vegetation (*Calamagrostis breweri*-*Trisetum spicatum* Herbaceous Vegetation [Provisional])*+ (n=4) 99K119, 99K123, 99K146, 99S141

Shorthair Reedgrass-Drummond Rush Herbaceous Vegetation (*Calamagrostis breweri*-*Juncus drummondii* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 99K121 [no description]

V.A.5.N.g.9 *CALAMAGROSTIS PURPURASCENS* HERBACEOUS ALLIANCE+ (Taylor, 1984) (n=1) 99S152

Purple Reedgrass-Granite Gilia Herbaceous Vegetation (*Calamagrostis purpurascens*-*Leptodactylon pungens* Herbaceous Vegetation) (Taylor, 1984) (n=3) 98K120, 99S162, 99S163

Purple Reedgrass-Parry Rabbitbrush-Granite Gilia Herbaceous Vegetation (*Calamagrostis purpurascens*-*Chrysothamnus parryi* ssp. *monocephalus*-*Leptodactylon pungens* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 218 [no description]

V.A.5.N.g.4 *CAREX BREWERI* HERBACEOUS ALLIANCE

Brewer Sedge Herbaceous Vegetation (*Carex breweri* Herbaceous Vegetation) (Taylor, 1984) (n=4) 99K156, 99K160, 99S155, 99K153

V.A.5.N.g.?? *CAREX CONGDONII-ARNICA AMPLEXICAULIS* HERBACEOUS ALLIANCE (Taylor 1984)+ (n=1) 98K121

European Red Elderberry/Congdon's Sedge Herbaceous Vegetation (*Sambucus racemosa/Carex congdonii* Herbaceous Vegetation) (Taylor, 1984)+ (n=1) 99S165 [no description]

V.A.5.N.g. 2 *CAREX (FILIFOLIA, EXSERTA)* HERBACEOUS ALLIANCE

Shorthair Sedge-Pussypaws Herbaceous Vegetation (*Carex exserta-Cistanthe* sp. Herbaceous Vegetation) (Burke, 1982) (n=2) 98M84, 98M101

Shorthair Sedge-Spike Trisetum Herbaceous Vegetation (*Carex exserta-Trisetum spicatum* Herbaceous Vegetation [Provisional])*+ (n=6) 99K134, 99S130, 99K149, 99K150, 237, 296

Shorthair Sedge-Sierra Beardtongue Herbaceous Vegetation (*Carex exserta - Penstemon heterodoxus* Herbaceous Vegetation [Provisional])* (n=10) 64, 78, 238, 98K72, 98K77, 98K78, 99K120, 98K71, 98M77, Potter 1668

V.A.5.N.g.?? *CAREX HELLERI* HERBACEOUS ALLIANCE [Provisional]+ (Taylor, 1984)

Heller Sedge-Silvery Buckwheat-Silky Raillardella Herbaceous Vegetation (*Carex helleri- Eriogonum incanum-Raillardella argentea* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 99S151 [no description]

Heller Sedge-Alpine Saxifrage-Woodrush Herbaceous Vegetation (*Carex helleri-Saxifraga tolmiei-Luzula divaricata* Herbaceous Vegetation) (Taylor, 1984)+ (n=1) 99K157 [no description]

Heller Sedge-Parry Rush Herbaceous Vegetation (*Carex helleri-Juncus parryi* Herbaceous Vegetation)+ (n=1) (Taylor, 1984) 99K161 [no description]

V.A.5.N.g.8 *CAREX SPECTABILIS* HERBACEOUS ALLIANCE

Showy Sedge-Arrowleaf Ragwort Herbaceous Vegetation (*Carex spectabilis-Senecio triangularis* Herbaceous Vegetation) (Taylor, 1984) (n=1) 99K158 [no description]

Showy Sedge-Sibbaldia Herbaceous Vegetation (*Carex spectabilis-Sibbaldia procumbens* Herbaceous Vegetation) (Taylor, 1984) (n=2) 99S124, 98K110 [no description]

**V.A.5.N.h. Short alpine or subalpine dry bunch grassland**

V.A.5.N.h.4 *DANTHONIA INTERMEDIA* HERBACEOUS ALLIANCE*+

Timber Oatgrass-Alpine Pussytoes Herbaceous Vegetation (*Danthonia intermedia-Antennaria rosea* Herbaceous Vegetation [Provisional])*+ (n=4) 98K87, 99S129, 99S132, Potter 1659

Timber Oatgrass-Sierra False Needlegrass Herbaceous Vegetation (*Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation [Provisional])*+ (n=1) 98M88 [no description]

V.A.5.N.h.14 *JUNCUS PARRYI* HERBACEOUS ALLIANCE

Parry Rush-Silvery Buckwheat Herbaceous Vegetation (*Juncus parryi-Eriogonum incanum* Herbaceous Vegetation) (Taylor, 1984) (n=7) 99K175, 98M122, 98K89, 98M127, 99K154, 99S150, 308

Parry Rush-Red Mountainheather Herbaceous Vegetation (*Juncus parryi-Phyllodoce breweri* Herbaceous Vegetation) (Taylor, 1984) (n=1) 98M95 [no description]

**V.A.5.N.j. Temporarily flooded temperate or subpolar grassland**

V.A.5.N.j.?? *CAREX JONESII* TEMPORARILY FLOODED HERBACEOUS ALLIANCE+ (Potter 2000 ms) Potter 1006 (n=1)

V.A.5.N.j.?? *GLYCERIA STRIATA* TEMPORARILY FLOODED HERBACEOUS ALLIANCE (PROVISIONAL)

Tall Mannagrass Herbaceous Vegetation (*Glyceria striata* [*Glyceria elata*, Hickman 1993] Herbaceous Vegetation [Provisional])*+ (n=6) 99K137, 99S137, 98K102, 98K122, 99K163, 99K127

**V.A.5.N.k. Seasonally flooded temperate or subpolar grassland**

V.A.5.N.k.39 *CALAMAGROSTIS CANADENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Canadian Reedgrass Herbaceous Vegetation (*Calamagrostis canadensis* Herbaceous Vegetation [Provisional])*+ (n=6) 99K111, 99S127, 99S138, 99S103, 99S109, 99S135

V.A.5.N.k.42 *CAREX (ROSTRATA, UTRICULATA)* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Northwest Territory Sedge [Beaked Sedge, Hickman 1993] Herbaceous Vegetation (*Carex utriculata* Herbaceous Vegetation) (Halpern, 1986, Taylor, 1984) (n=11) 98K74, 98M85, 98K69, 98K97, 98M90, 99S108, 99S136, 75, Potter 1607, 1609, 1663, 1030

V.A.5.N.k.43 *CAREX AQUATILIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE+ (n=1) 98K82, some Potter plots (in 2000 ms)

V.A.5.N.k.53 *CAREX PELLITA* [*Carex lanuginosa*, Hickman 1993] SEASONALLY FLOODED HERBACEOUS ALLIANCE [unsubstantiated in the study area]

V.A.5.N.k.56 *CAREX NEBRASCENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Nebraska Sedge Herbaceous Vegetation (*Carex nebrascensis* Herbaceous Vegetation) (Beguin & Major, 1975) (n=3) 98M109, 99K130, 99K138

V.A.5.N.k.57 *CAREX NIGRICANS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Black Alpine Sedge-Bog Laurel Herbaceous Vegetation (*Carex nigricans-Kalmia polifolia* Herbaceous Vegetation [Provisional])+ (Taylor, 1984) (n=1) 98M124

V.A.5.N.k.59 *CAREX SCOPULORUM* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Rocky Mountain Sedge Herbaceous Vegetation (*Carex scopulorum* var. *bracteosa* Herbaceous Vegetation [Provisional])* (n=14) 98K73, 98K108, 98K92, 98M66, 99K142, 99K143, 99K147, 99S145, 99S148, 98M125 Potter 1010, 1012, 1013, 1562

V.A.5.N.k.200 *CAREX VESICARIA* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Bristly Sedge Herbaceous Vegetation (*Carex vesicaria* Herbaceous Vegetation)*+ (n=8) 99K102, 99K113, 99K115, 99S133, Potter 1613, 1611, 1615, 1649

V.A.5.N.k.47 *DESCHAMPSIA CAESPITOSA* [*Deschampsia cespitosa*, Hickman 1993] SEASONALLY FLOODED HERBACEOUS ALLIANCE

Tufted Hairgrass-Polygonum Herbaceous Vegetation (*Deschampsia caespitosa-Polygonum bistortoides* Herbaceous Vegetation) "SUB-ALLIANCE" (n=13) Note: As a result of the overlap between associations defined either from limited data or from elsewhere in the Sierra, the 13 samples collected representing this alliance were lumped into one group with *P. bistortoides* as the main indicator species. The following previously defined associations have been at least temporarily subsumed for the Yosemite classification: Tufted hairgrass-Coville ragwort (*Deschampsia caespitosa-Senecio scorzonella*) association (Benedict, 1983) (n=4) 98M93, 98M82, 99K151, 99K173; Tufted hairgrass-mountain goldenrod (*Deschampsia caespitosa-Solidago multiradiata*) association (Taylor, 1984) (n=1) 99K174; Tufted hairgrass (*Deschampsia caespitosa*) association (n=5) 99K107, 99K101, 99K139, 98M81, Potter 1650; Tufted hairgrass-Longstalk clover (*Deschampsia caespitosa-Trifolium longipes*) association (Ratliff, 1982, 1985) (n=1) 99S119; and Tufted hairgrass-Brewer bittercress association (*Deschampsia caespitosa-Cardamine breweri)* (Benedict, 1983) (n=2) 99S114, 99S118

V.A.5.N.k.62 *ELEOCHARIS QUINQUEFLORA* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Few-Flowered Spikerush Herbaceous Vegetation (*Eleocharis quinqueflora* [*E. pauciflora*, Hickman 1993] Herbaceous Vegetation) (Benedict, 1983) (n=5) 98K76, 98K80, 99S113, 99S117, 99S120

V.A.5.N.k.13 *JUNCUS BALTICUS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Baltic Rush-(Mexican Rush) Herbaceous Vegetation [*Juncus balticus-(Juncus mexicanus)* Herbaceous Vegetation] (n=6) 98K55, 98K57, 98M28, 98M57, 99K78, 98M87

V.A.5.N.k.?? *JUNCUS NEVADENSIS* HERBACEOUS ALLIANCE (POTTER, 2000 MS) (n=0)

Nevada Rush - Hare Sedge Herbaceous Vegetation (*Juncus nevadensis-Carex leporinella* Herbaceous Vegetation [Provisional])*+ (n=1) 98K39 [no description]

V.A.5.N.k.21 *POA PRATENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

Kentucky Bluegrass Herbaceous Vegetation (*Poa pratensis* Herbaceous Vegetation) (Potter, 2000 ms) (n=6) 98K30, 98K26, 98M72, 66, 151, 283

V.A.5.N.k?? *PTILAGROSTIS KINGII* SEASONALLY FLOODED HERBACEOUS ALLIANCE (Potter, 2000 ms)

Sierra False Needlegrass (King's Ricegrass, Hickman 1993) Herbaceous Vegetation (*Ptilagrostis kingii* Herbaceous Vegetation [Provisional])*+ (Potter 2000 ms) (n=6) 98M103, 98M98, 98K109, 175, Potter 1661, 1670

**V.A.5.N.m. Saturated temperate or subpolar grassland**

V.A.5.N.I.9 *TYPHA (ANGUSTIFOLIA, LATIFOLIA)-(SCIRPUS SPP.)* SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (n=3) 99S50, 99S55, 99K36

**V.A.7.N.g. Medium-tall temperate or subpolar grassland with a sparse cold deciduous shrub layer**

V.A.7.N.g.2 *DASIPHORA FLORIBUNDA* SHRUB HERBACEOUS ALLIANCE

Shrubby Cinquefoil/Timber Oatgrass Herbaceous Vegetation (*Dasiphora floribunda* [*Potentilla fruticosa*, Hickman 1993]*/Danthonia intermedia* Herbaceous Vegetation [Provisional])+ (Taylor 1984) (n=3) 98K124, 99K133, 99K152

**V.B. Perennial forb vegetation. Forbs (including ferns) usually greater than one meter tall when inflorescences fully developed generally contributing to greater than 50 percent of total herbaceous cover.**

**V.B.2.N.a. Tall temperate or subpolar perennial forb vegetation**

V.B.2.N.a.?? *SOLIDAGO CANADENSIS --ACHILLEA MILLEFOLIUM* HERBACEOUS ALLIANCE [PROVISIONAL]

Canada Goldenrod-Yarrow Herbaceous Vegetation (*Solidago canadensis-Achillea millefolium* Herbaceous Vegetation [Provisional])*+ (n=4) 99K104, 99S121, 98M61, 284

**V.B.2.N.b. Low temperate or subpolar perennial forb vegetation**

V.B.2.N.b.?? *HULSEA ALGIDA* HERBACEOUS ALLIANCE (1) (Taylor, 1984) [PROVISIONAL]

Alpine Hulsea-Alpine Goldenbush-Alpine Phacelia Herbaceous Vegetation (*Hulsea algida-Ericameria discoidea-Phacelia hastata* ssp. *compacta* Herbaceous Vegetation [Provisional])+ (Taylor, 1984) (n=1) 99S154 [no description]

V.B.2.N.b ?? *MINUARTIA NUTTALLII-ERICAMERIA DISCOIDEA* HERBACEOUS ALLIANCE+ (Taylor, 1984) (n=1) 98M126

King's Compact Sandwort-Western Needlegrass Herbaceous Vegetation (*Arenaria kingii* ssp. *compacta-Achnatherum occidentale* ssp. *occidentale* Herbaceous Vegetation [Provisional])*+ (n=1) 98K85 [no description]

V.B.2.N.b?? *OXYRIA DIGYNA* HERBACEOUS ALLIANCE+ (Taylor, 1984)

Alpine Sorrel-Lemmon's Draba Herbaceous Vegetation (*Draba lemmonii-Oxyria digyna* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 240 [no description]

V.B.2.N.b?? *PENSTEMON RYDBERGII VAR. OREOCHARIS* STANDS (n=1) [PROVISIONAL] 98M106

V.B.2.N.b?? P*ENSTEMON NEWBERRYI-STREPTANTHUS TORTUOSUS* HERBACEOUS ALLIANCE (Taylor, 1984) [PROVISIONAL]+ (n=0)

Mountain Pride-Shieldplant/Watson's Spike-moss Herbaceous Vegetation (*Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii* Herbaceous Vegetation) (Taylor, 1984) (n=4) 98M79, 98K84, 98K100, 244

Sierra Spirea-Mountain Pride-Shieldplant Herbaceous Vegetation (*Spiraea splendens* var. *splendens* [*Spiraea densiflora*, Hickman 1993]-*Penstemon newberry-Streptanthus tortuosus* Herbaceous Vegetation) (Taylor, 1984) (n=7) 98M110, 98K98, 344, 302, 132, 305, 335

Mountain Pride-Shieldplant-Sierra Stonecrop-Mountain Muhly Herbaceous Vegetation (*Penstemon newberryi-Streptanthus tortuosus-Sedum obtusatum* ssp. *boreale-Muhlenbergia montana* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 341 [no description]

V.B.2.N.b?? *PHLOX COVILLEI - ELYMUS ELYMOIDES* HERBACEOUS ALLIANCE+ (Taylor) [PROVISIONAL] (n=0)

Coville Phlox-Squirreltail-Small-flowered Fescue-Davidson Penstemon Herbaceous Vegetation (*Phlox covillei-Elymus elymoides-Festuca minutiflora-Penstemon davidsonii* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 239 [no description]

Coville Phlox-Squirreltail-Nevada Podistera Herbaceous Vegetation (*Phlox covillei-Elymus elymoides-Podistera nevadensis* Herbaceous Vegetation) (Taylor, 1984) (n=4) 98K118, 98M119, 98M120, 98M121

Coville Phlox-Squirreltail-Nevada Podistera-Pygmy Daisy Herbaceous Vegetation (*Phlox covillei-Podistera nevadensis-Elymus elymoides-Erigeron pygmaeus* Herbaceous Vegetation) (Taylor, 1984) (n=8) 217, 255, 294, 295, 297, 313, 306, 307

V.B.2.N.b.?? *SAXIFRAGA NIDIFICA-MIMULUS RUBELLUS* HERBACEOUS ALLIANCE (TAYLOR, 1984) [PROVISIONAL]

Ledge Stonecrop-Watson's Spike-moss Herbaceous Vegetation (*Rhodiola integrifolia* ssp. *integrifolia* [*Sedum roseum* ssp. *integrifolium*, Hickman 1993]-*Selaginella watsonii* Herbaceous Vegetation)+ (Taylor, 1984) (n=1) 98M112 [no description]

**V.B.2.N.d. Temporarily flooded temperate perennial forb vegetation**

V.B.2.N.d.?? *OREOSTEMMA ALPIGENUM* VAR. *ANDERSONII* [*Aster alpigenus* var. *andersonii*, Hickman 1993]) HERBACEOUS ALLIANCE [PROVISIONAL]*+ (n=1) 98K88

V.B.2.N.d.?? *ARNICA MOLLIS* HERBACEOUS ALLIANCE [PROVISIONAL]*+ (n=1) 99K135

V.B.2.N.d. ?? *LUPINUS LATIFOLIUS* HERBACEOUS ALLIANCE [PROVISIONAL]

Broadleaf Lupine Herbaceous Vegetation (*Lupinus latifolius* Herbaceous Vegetation [Provisional])*+ (n=4) 114, 98K61, 99K136, 98K125

V.B.2.N.d.?? *POLYGONUM BISTORTOIDES* HERBACEOUS ALLIANCE [PROVISIONAL]*+ (Ratliff, 1982, 1985) (n=4) 99S102, 98M63, 99K100, 99S30

V.B.2.N.d.8 *VERATRUM CALIFORNICUM* TEMPORARILY FLOODED HERBACEOUS ALLIANCE [the single association below may also be in *SENECIO TRIANGULARIS* TEMPORARILY FLOODED HERBACEOUS ALLIANCE V.B.2.N.d.12]

California False Hellebore-Arrowleaf Ragwort Herbaceous Vegetation (*Veratrum californicum-Senecio triangularis* Herbaceous Vegetation) (Taylor, 1984) (n=4) 98K66, 98M105, 98K95, Potter 1511

**V.C. Hydromorphic rooted vegetation. Nonemergent graminoids and forbs structurally supported by water and rooted in substrate (e.g., pond weeds and water lilies).**

**V.C.2.N.a. Permanently flooded temperate or subpolar hydromorphic rooted vegetation**

V.C.2.N.a.6 *ISOETES (BOLANDERI, ECHINOSPORA, OCCIDENTALIS, NUTTALLII)* PERMANENTLY FLOODED HERBACEOUS ALLIANCE (n=0) [new alliance defined with data from this project; requires further sampling for verification]

Western Quillwort Herbaceous Vegetation (*Isoetes occidentalis* Herbaceous Vegetation)*+ (n=2) 99S111, 99S115 [no description]

Western Quillwort-Spiked False Mannagrass Herbaceous Vegetation (*Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation)*+ (similar to Taylor 1984) (n=1) 98M115 [no description]

V.C.2.N.a.9 *NUPHAR LUTEA* SSP. *POLYSEPALA* PERMANENTLY FLOODED HERBACEOUS ALLIANCE (n=0) (Not verified from the study area)

V.C.2.N.a.23 *POTAMOGETON (DIVERSIFOLIUS, FILIFORMIS)* PERMANENTLY FLOODED HERBACEOUS ALLIANCE (n=0) (Not verified from the study area)

V.C.2.N.a.20 *SPARGANIUM ANGUSTIFOLIUM* PERMANENTLY FLOODED HERBACEOUS ALLIANCE

Narrow-Leaf Bur-Reed Herbaceous Vegetation (*Sparganium angustifolium* Herbaceous Vegetation [Provisional])*+ (n=5) 98M102, 98M97, 99K103, 99K140, 98M100

**V.D. Annual graminoid or forb vegetation. Graminoids or forbs usually less than 0.5 meter tall when inflorescences are fully developed, generally contributing greater than 50 percent of total herbaceous cover.**

**V.D.2.N.c.?? Short temperate annual forbs?**

V.D.2.N.c.?? *CENTAUREA SOLSTITIALIS* HERBACEOUS ALLIANCE [Provisional]*+ (n=1) 98K4 [no description]

V.D.2.N.c.?? CALIFORNIA ANNUAL HERBLAND ALLIANCE*+ (n=3) 98M27, 98M21, 98M29

**V.D.2.N.d. Short temperate annual grassland**

V.D.2.N.d.1 *BROMUS (HORDEACEUS, DIANDRUS, MADRITENSIS)* HERBACEOUS ALLIANCE (California annual grassland Alliance)

Soft Chess-Ripgut Brome-(Compact Brome)-Small-head Clover-American Wild Carrot Herbaceous Vegetation (*Bromus hordeaceus-B. diandrus-(B. madritensis)-Trifolium* microcephalum-*Daucus pusillus* Herbaceous Vegetation [Provisional])*+ (n=3) 99S17, 98K2, 98K5

# Appendix J: Key to Yosemite Alliances and Associations, Based on Floristics

**June 21, 2002 Version**

**Instructions for following key:** This is not a strictly dichotomous key. Due to the diversity of vegetation in the mapping area and for brevity, there are not couplets for each option. Instead, there are a set of characteristics with choices beneath each of these. The key will first lead the user to the general options, and the individual selections for the vegetation associations will be listed beneath these options. To arrive at the correct choice, simply work through the numbered list of types that lead you from the more general to the most specific options until the best fit is reached. Each of the choices is identified by a combination of alphanumeric codes, using numerals, capital letters, lowercase letters, and decimal points to distinguish different key levels. The most basic general levels in the key are on the left side of the alphanumeric code, and the most specific are on the right side. The coding system for each item in the key relates to a series of left indentations. Thus, by training your eyes down the left-hand side of the pages, you will note the major groupings and nested within them the subgroupings that will lead you to the correct answer. The preliminary key will direct you to the major groups, such as forest/woodland, shrubland, and herbaceous, with the more specific choice beneath them. The more specific lists within these are generally based on presence/absence or dominance/subordinance of significant species until you arrive at the optimum choice. **Important:** since there may be more than two alternatives in a group, be sure to work through all of the options in a list before selecting the best choice for a stand.

**Woodlands versus forest:** Because many Yosemite tree-dominated alliances range from forest to woodland or even sparsely wooded shrubland or herbland, I have included keys to both forest and woodland segments under 100A Evergreen forest and 100B Winter deciduous forests and woodlands.

**Adherence to the U.S. National Vegetation Classification:** The reality of ecological relationships in vegetation often blurs the predetermined decision rules differentiating forest, woodland, scrub, dwarf scrub, and other categories in the national classification. As a result, I have maintained the national rules for cover thresholds in the main keys but have chosen to identify the alliances and the associations within them by their ecological relatedness rather than strictly physiognomic criteria. To have flexibility, I have included potentially misinterpreted vegetation types in other possible locations in the key.

There is a broad conceptual gap between the floristic units of classification at the lower end of the USNVC hierarchy and the physiognomic units at the middle and upper levels of the national classification. There is no simple way to address this disconnection. If we rely on classification analysis of floristic units of vegetation (species cover and presence) to drive the classification, there should be only the results of that analysis to determine the middle and upper levels.

## DEFINITIONS

**Cutoff Values:** The absolute percentages of species cover used for threshold values in the definition of types are generally derived from the TWINSPAN pseudospecies cutoff values. For the NRI and the Wieslander data these cutoffs were: present—5 percent, greater than 5 percent–25 percent, and greater than 25 percent cover. For the 1998–1999 data the cutoffs used were: present—less than 1 percent, 1 percent–5 percent, greater than 5 percent–10 percent, greater than 10 percent–20 percent, and greater than 20 percent absolute cover. Thus, specific rules assigned to certain vegetation types are largely based on the principal data set(s) used to define them. If multiple data sets were used for the definition, then common cutoffs (5% and 25%) were used.

**Dominance (dominated, dominant, strongly dominated by):** This term refers to the preponderance of the vegetation cover in a stand of uniform composition and site history. It may refer to cover of an individual plant (as in dominated by *Pinus contorta* var. *murrayana,* or it may refer to dominance by a physiognomic type as in "stand dominated by shrubs." In the strict sense, dominance refers to the relative cover of one species or physiognomic type as compared to another species or physiognomic type. Anything over 50 percent relative cover is said to dominate a stand. Those species or physiognomic types that do not strongly dominate (considered to be 60% or greater relative cover) are treated in alternate keys so precise estimation is not necessary to arrive at the correct determination in the key.

**Importance (important):** A species is considered "important" in a stand or a vegetation type if it is greater than 1 percent absolute cover. However, in general, importance is a relative term with the proportion of the important species contrasted to the total cover of all species in the same layer. If there is a specific relative percentage identified for a vegetation type then it is mentioned in the key. This term is usually contrasted with "dominant" to mean that the species referenced is always present in the vegetation and always greater than 1 percent cover but not always dominant (> 50% relative cover).

**Open:** This is the term ascribed to individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is generally less than 30 percent absolute cover.

**Intermittent:** This is the term ascribed to individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is generally between about 30 percent and 60 percent absolute cover.

**Continuous:** This is the term ascribed to individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is generally greater than 60 percent absolute cover.

**Conspicuous:** Statements containing "conspicuous" are relative in meaning. For example, "conspicuous in canopy" means that in every stand a "conspicuous" species should be easily observed without a thorough searching of the stand. This is in contrast with **"inconspicuous,"** which implies that although the species may be present, it is not usually easily found without a thorough search of the stand. A conspicuous species is not necessarily dominant, but it is "important" (at least 1% cover).

**Relative cover:** This term means the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the amount of surface of the plot or stand covered by all species or groups. Thus, 50 percent relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Relative cover values are proportional numbers and, if added, total 100 percent for each stand (plot sample).

**Absolute cover:** This is the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species, for example, *Pinus ponderosa* covers between 5 percent and 10 percent of the stand. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100 percent because it is not a proportional number.

**Shrubs:** A shrub is a multistemmed woody plant that is between 0.2 meters and 5 meters tall. Definitions are blurred at the low and the high ends of the height scales. Small multistemmed trees approximately 4 meters tall and large woody herbaceous species less than 0.5 meters tall are individually treated in the keys and distinguished from shrubs.

**Subshrubs:** Subshrubs are considered multistemmed woody plants less than 0.5 meter tall on average.

**Sparse:** This is a generic term relating to low widely spaced cover of individuals of a species or physiognomic group. Sparsely vegetated is defined as less than 2 percent cover of vegetation, sparse canopy is less than 10 percent (see Emergent).

**Stand:** A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small such as alpine meadow or tundra types, and some may be several square kilometers in size such as desert or forest types. A stand is defined by two main unifying characteristics.

1. It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.
2. It has *structural* integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, a sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called *homogeneity*. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous.

**Emergent:** This is a structural layer of vegetation that rises above the main canopy layer. It may be large trees over mid-sized or short trees, or large shrubs over denser subshrubs or herbaceous

layers. Generally emergents are less than 10 percent absolute cover and are underlain by a denser subcanopy or understory.

**Woody plant:** This is any species of plant that has noticeably woody stems. It does not include herbaceous species with woody underground portions such as tubers, roots, or rhizomes.

**Forest:** In the U.S. National Vegetation Classification, a forest is defined as a tree-dominated stand of vegetation with 60 percent or greater cover of trees.

**Woodland:** In the U.S. National Vegetation Classification, a woodland is defined as a tree-dominated stand of vegetation with between 25 percent and 60 percent cover of trees.

**Sparsely wooded:** There are stands with trees conspicuous, but less than 25 percent cover may occur over shrubs as the dominant canopy (sparsely wooded shrubland) or herbaceous cover (sparsely wooded herbaceous).

**West side:** This refers to the area of the mapping project west of the Sierra Nevada crest.

**East side:** This refers to the area of the mapping project east of the Sierra Nevada crest.

**Ecological Zones :** See definitions in the beginning of this report, but brief definitions are as follows:

Zone I: West slope oak woodland and chaparral
Zone II: West slope ponderosa pine and California black oak (lower mixed conifer zone)
Zone III: West slope California red fir zone
Zone IV: West slope subalpine zone
Zone V: West slope alpine
Zone VI: East slope alpine
Zone VII: East slope subalpine conifer zone
Zone VIII: East slope pinyon pine and sagebrush zone

**Sample sizes**: Sample sizes following type names within the key show the number of samples from among all data sets used for the project. They reflect how well supported the type is for the project area.

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## Key to Main Vegetation Divisions

**I.** Trees (at least 5 meters tall) evenly distributed and conspicuous throughout stand. In areas where vegetation covers greater than ca. 20 percent, tree canopy may be as low as 10 percent over denser subcanopies of shrub and herbaceous species. In areas where vegetation is less than 20 percent total cover, trees may cover less than 10 percent, but are at least 50 percent relative cover and evenly distributed across the stand = **Division 100, Tree Vegetation**

**II.** Vegetation dominated by woody shrubs or subshrubs. When total vegetation cover is over ca. 20 percent trees, if present, generally less than 10 percent cover in stand, herbaceous species may total higher cover than shrubs but are shorter in stature. Shrubs are always at least 10

percent cover. In areas where vegetation is less than 20 percent total cover, shrubs may cover less than 10 percent but are at least 50 percent relative cover and evenly distributed across the stand = **Division 200, Shrub Vegetation**

**III.** Vegetation dominated by nonwoody herbaceous species including grasses, graminoids, and broad-leaved herbaceous species. When total vegetation cover is greater than ca. 20 percent, shrub and subshrub species and trees, if present, of lower cover than herbs and less than 10 percent. If total vegetation cover is less than ca. 20 percent, shrubs, subshrubs, and/or trees may be present but are less than 50 percent relative cover with herbaceous species predominating **=** **Division 300, Herbaceous Vegetation**

**IV.** Total plant cover generally less than 2 percent includes boulder, gravel, cobble, or talus sparse vegetation. Sparsely vegetated sand accumulations, high mountain talus/scree, intermittently flooded mudflats, and recent soil slumps or landslides = **Division 400, Sparsely Vegetated to Nonvegetated.** Not specifically treated further in this key.

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**DIVISION 100: VEGETATION CHARACTERIZED BY TREES 100 Three main groups are individuated in the key: evergreen forests and woodlands, deciduous forests and woodlands, and mixed evergreen and deciduous forests and woodlands.**

**100A Evergreen forest. Evergreen species generally contribute greater than 75 percent of the total (relative) tree cover. Most alliances are modally considered forest, but canopy cover of trees may range down into woodland (25%–60% tree cover), or even sparsely wooded shrubland or herbaceous (< 25% cover of trees) class for some alliances.**

100A.1 Canopy usually dominated by sclerophyllous broad-leaved evergreen species. Occasionally, conifers and broad-leaved evergreen species are codominant, but usually the conifers form a more open emergent layer over a denser canopy of broad-leaved trees.

100A.1A Canopy typically with greater than 50 percent relative cover of *Quercus chrysolepis* (canyon live oak) sometimes with emergent conifers I.A.6.N.b.2 = ***QUERCUS CHRYSOLEPIS* FOREST ALLIANCE**

100A.1Aa *Umbellularia californica* (California Laurel) present in stand; usually moderate to steep rocky slopes, often concave; the shrub *Keckiella antirrhinoides* frequently (> = 50% of plots) present in the understory; *Toxicodendron diversilobum* (poison oak) present in virtually all plots may include up to 25 percent cover of California black oak (*Quercus kelloggii*) in tree layer **= Canyon Live Oak-California Laurel/(*Keckiella*) Forest [*Quercus chrysolepis-Umbellularia californica/(Keckiella antirrhinoides)* Forest] (n=20)**

100A.1Ab *Arctostaphylos viscida* (whiteleaf manzanita) a conspicuous (from 2%–50% cover) understory shrub = **Canyon Live Oak/Whiteleaf Manzanita Forest [*Quercus chrysolepis/Arctostaphylos viscida* Forest] (n=17)**

100A.1Ac *Arctostaphylos patula* (greenleaf manzanita) present as principal understory shrub; *Q. chrysolepis* may be shrubby = **Canyon Live Oak/Greenleaf Manzanita Forest [*Quercus chrysolepis/Arctostaphylos patula* Forest] (n=5)**

100A.1Ad *Pinus sabiniana* (gray pine) forms a usually sparse emergent overstory over an open to continuous canopy of *Q. chrysolepis*. Total tree cover may cross the boundary of forest/woodland cover; shallow rocky soil commonly with outcrops of bedrock = **Canyon Live Oak–Gray Pine Forest** [***Quercus chrysolepis-Pinus sabiniana* Forest] (n=8)**

100A.1Ae *Pinus ponderosa* (ponderosa pine) forms a usually sparse emergent overstory over intermittent to continuous canopy of *Q. chrysolepis* = **Canyon Live Oak-Ponderosa Pine Forest [*Quercus chrysolepis-Pinus ponderosa* Forest] (n=3)**

100A.1Af *Calocedrus decurrens* (incense cedar) may form emergent layer or be present in main canopy with *Quercus chrysolepis;* typically riparian or semiriparian lower slope settings = **Canyon Live Oak -Incense Cedar Forest [*Quercus chrysolepis-Calocedrus decurrens* Forest] (n=3)**

100A.1B Another oak or broad-leaved evergreen tree dominant; either *Quercus wislizeni* (interior live oak), *Cercocarpus ledifolius* (curl-leaf mountain mahogany) or *Cercocarpus betuloides* (birchleaf mountain mahogany). All of these species may take shrub or tree forms depending on disturbance history, site productivity, and other factors.

100A.1Ba Canopy dominated by the small tree or large shrub, *Cercocarpus ledifolius*. Occurs principally in ecological Zones VII and VIII on the east side of the crest on steep rocky sites; associated with *Artemisia tridentata* (big sage) and other Great Basin species = **II.A.5.N.a.1 *CERCOCARPUS LEDIFOLIUS* WOODLAND ALLIANCE.** Note: Stands vary. Although most fall into woodland with less than 60 percent canopy cover, there are two unclassifiable plots characterized by high canopy cover. Only one association defined locally with *Symphoricarpos rotundifolius* (roundleaf snowberry) as the characteristic understory species:

**Curl-leaf Mountain Mahogany/Roundleaf Snowberry Woodland [*Cercocarpus ledifolius/Symphoricarpos rotundifolius* Woodland] (n=8)**

100A.1Bb A short woodland or tall scrub of the west side of the Sierra Nevada in ecological Zones I and II with *Cercocarpus montanus* var. *glaber* (*C. betuloides* var. *betuloides*, Hickman 1993) as the dominant overstory species; may mix with lesser cover of other chaparral shrubs including *Arctostaphylos viscida* and *Ceanothus cuneatus* = **II.A.5.N.a.2 *CERCOCARPUS MONTANUS* VAR. *GLABER* (*C. betuloides* var. *betuloides*, Hickman 1993 nomenclature) SHRUBLAND ALLIANCE**

Only one association formally identified with *Cercocarpus montanus* forming a moderately dense canopy over sparse shrub and sparse herbaceous layers = **Birchleaf Mountain Mahogany Sierran Chaparral Shrubland [*Cercocarpus montanus* var. *glaber* Sierran Chaparral Shrubland (*Cercocarpus betuloides* var. *betuloides*, Hickman 1993)] (n=5)**

100A.1Bc Interior live oak (*Quercus wislizeni*) dominant or important in the canopy. If *Pinus sabiniana* important or conspicuous, see also *Pinus sabiniana* woodland alliance. If *Q. wislizeni* not dominant, *Q. wislizeni* may share dominance with *Q. chrysolepis* (canyon live oak) = **II.A.5.N.a.6 *QUERCUS WISLIZENI* WOODLAND ALLIANCE**

100A.1Bc.1 Either interior live oak or canyon live oak may dominate the canopy, but both are important (> 30% relative cover). Stands are typically in low slope or ravine settings in ecological Zone I = **Interior Live Oak-Canyon Live Oak Woodland [*Quercus wislizeni-Quercus chrysolepis* Woodland] (n=3)**

100A.1Bc.2 *Q. wislizeni* is the sole dominant tree with the large shrub *Arctostaphylos viscida* (whiteleaf manzanita) as the understory indicator; there may be substantial grass in the herb layer = **Interior Live Oak/Whiteleaf Manzanita Woodland [*Quercus wislizeni/Arctostaphylos viscida* Woodland] (Allen et al., 1991) [n=2]**

100A.1Bc.3 Dominated by *Quercus wislizeni* in the overstory; *Pinus sabiniana* and *Quercus douglasii* are less cover, but important or conspicuous **= Interior Live Oak-Blue Oak-Gray Pine/Brome Species-American Wild Carrot Woodland [*Quercus wislizeni-Quercus douglasii-Pinus sabiniana/Bromus* spp.-*Daucus pusillus* Woodland] (Allen et al., 1991)**

**100A.2 Canopy dominated by needle-leaved or scale-leaved coniferous trees**

100A.2A Emergent layer or canopy of *Sequoiadendron giganteum* present, typically over denser canopy or subcanopy of other conifers. *S. giganteum* must at least occur as a regular emergent and not as an isolated single tree to fit definition **= I.A.8.N.a.1 SEQUOIADENDRON GIGANTEUM FOREST ALLIANCE**

100A.2Aa *S. giganteum* emergent over second tier of conifers with sugar pine present and a subcanopy containing *Cornus nuttalli* (Pacific dogwood), includes all major stands of alliance in area = **Giant Sequoia-Sugar Pine/Pacific Dogwood Forest [*Sequoiadendron giganteum-Pinus lambertiana/Cornus nuttalli* Forest] (n=11)**

100A.2B No emergent *Sequoiadendron*, canopy composed of needle-leaved conifers with rounded or conical crowns; may include relatively open woodlands and denser forest types

100A.2Ba Pines (*Pinus* spp.) are the dominant and/or one of the characteristic conifer species of the tree canopy forming forests, woodlands, or sparsely wooded stands. Some stands may be mixed with scale-leaved conifers, deciduous and/or broad-leaved evergreen tree species. However, pines are always conspicuous. (Note: This is a long list of nine individual pine groups; those not familiar with the flora should work through the list to eliminate all possibilities.)

100A.2Ba.1 *Pinus contorta* ssp. *murrayana* (Sierra lodgepole pine) dominates or is an important constituent of canopy; usually greater than 50 percent relative canopy cover, but it may mix with *Pinus albicaulis* (whitebark pine) in subalpine stands where either species may be dominant (see Sierra lodgepole pine-whitebark pine/Ross sedge Forest). (Also see Quaking Aspen-Sierra lodgepole pine/Big sagebrush/Kentucky bluegrass Forest of *Populus tremuloides* alliance and Tsuga mertensiana Forest Alliance where Tsuga >30% relative cover.) **= I.A.8.N.b.4 *PINUS CONTORTA* FOREST ALLIANCE**.

100A.2 Ba.1a *Pinus albicaulis* (whitebark pine) present in canopy or shrub layer, usually at less than 50 percent relative cover (if greater than 50%, also see *Pinus albicaulis* Woodland Alliance), typically herbaceous species sparse to moderate cover.

100A.2Ba.1a.1 *Carex rossii* (Ross sedge) present in understory in at least 1 percent cover, typically intermittent to well developed forest cover in subalpine uplands, *Carex exserta* (shorthair sedge) absent or inconspicuous and of lower relative cover than *Carex rossii* **= Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest [*Pinus contorta* var. *murrayana-Pinus albicaulis/Carex rossii* Forest (n=32)**

100A.2Ba.1a.2 *P. contorta* and *P. albicaulis* may be more commonly considered to be forming a woodland than a forest; *Carex exserta* (shorthair sedge) conspicuous, generally on more open rocky stands than above or slopes with at least some fine grained substrate such as decomposed granite. Few samples, but consistently seen in field visits = **Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest [*Pinus contorta* var. *murrayana-Pinus albicaulis/Carex exserta* Forest] (n=2)**

100A.2Ba.1b. Understory well developed with herbaceous and/or mesic shrub or subshrub species; *Pinus albicaulis* not important in canopy.

100A.2Ba.1b.1. *Populus tremuloides* (quaking aspen) important or even marginally dominant in stands, usually mesic understory including *Poa pratensis* and scattered

*Artemisia tridentata*. Eastside meadows and low gradient creek banks = **Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest [*Populus tremuloides-Pinus contorta/Artemisia tridentata/Poa pratensis* Forest] (n=4) of the *Populus tremuloides* Forest Alliance**

100A.2Ba.1b.2. A type of mesic to subhydric conditions; edges of streams or seapages. Canopy cover generally intermittent to continuous; the shrub *Ledum* (*Rhododendron*) *glandulosum* present and usually conspicuous in understory. *Vaccinium uliginosum* (bog blueberry) may be present **= Sierra Lodgepole Pine/Western Labrador Tea Forest [*Pinus contorta* var. *murrayana*/*Ledum glandulosum* Forest] (Taylor, 1984 and Potter 2000 ms) (n=6)**

100A.2Ba.1b.3 In similar conditions to above, but usually somewhat drier and less productive sites on lower slopes or meadow edges, stands usually open to intermittent; *Ledum glandulosum* absent or inconspicuous in understory, *Vaccinium uliginosum* conspicuous creeping subshrub **= Sierra Lodgepole Pine/Bog Blueberry Forest [*Pinus contorta* var. *murrayana*/*Vaccinium uliginosum* Forest] (n=4)**

100A.2Ba.1b.4 Mesic herbaceous understory usually moderately to well developed; *Ligusticum grayi* [Gray's licorice-root (Gray's lovage)] present, other above species absent or inconspicuous; *Thalictrum fendleri* (Fendler's meadow rue), *Perideridia parishii* (Parish's yampah), *Trifolium* sp. (clover), and other herbs may be common, lower slopes, meadow edges, canopy usually greater than 50 percent cover **= Sierra Lodgepole Pine/Gray's Licorice-root (Gray's Lovage) Forest [*Pinus contorta* var. *murrayana/Ligusticum grayi* Forest] (Potter, 1998) (n=26)**

100A.2Ba.1b.5 Zone 7-8. Mesic herbaceous understory but with a shrub component of *Artemisia tridentate*. *Poa pratensis* present along with other Zone 7-8 meadow species. Canopy relatively open. = **Sierra Lodgepole Pine/(Big Sagebrush)/Kentucky Bluegrass Meadow Edge Mapping Unit [*Pinus contorta* var. *murrayana*/(*Artemisia tridentata* ssp. *tridentata*)/(*Poa pratensis*) Meadow Edge Mapping Unit**.]

100A.2.Ba.1c Understory with either xerophytic shrubs or poorly developed with scattered herbs and shrubs except for the first association listed (100A.2Ba.1c.1); *Pinus contorta* usually in open or even sparse stands

100A.2Ba.1c.1 *Pinus contorta* forms intermittent to continuous canopy (generally > 50% cover) over sparsely developed understory (< 10%), with no species characteristic. *Abies magnifica* (California red fir) is present in canopy and understory. (Note: This is part of Potter's (1998) description. Because he did not sample the full range of variability of *Pinus contorta* woodland and forest, we restrict this definition to include stands with at least 1 percent *Abies magnifica*. This would equate to the lower and warmer stands of Sierra

lodgepole pine where the tree absolute cover is greater than 35 percent, widespread on slopes and flats with few rock outcrops **= Sierra Lodgepole Pine Forest [*Pinus contorta* var. *murrayana* Forest] (Potter, 1998 in part)) (n=29)**

100A.2Ba.1c.2 *Artemisia tridentata* (primarily ssp. *vaseyana*) conspicuous in understory, tree canopy generally intermittent to open, may be on east side or west side, may have *Pinus jeffreyi, Abies magnifica* in moderate cover, generally of middle or lower slopes **= Sierra Lodgepole Pine/Big Sagebrush Forest [*Pinus contorta* var. *murrayana/Artemisia tridentata* Forest] (Potter, 1998) (n=2)**

100A.2Ba.1c.3 *Pinus contorta* var. *murrayana* forms open stands (> 10% and < 50% absolute tree cover), with sparse herbaceous and shrub understory. *Carex exserta* (shorthair sedge), if present, less than 5 percent absolute cover. Substrate is rocky with frequent outcrops and poorly developed soil. Note: This is part of Potter's (1998) description. Because he did not sample the full range of variability of *Pinus contorta* woodland and forest, we restrict this definition to include stands with at least 1 percent *Abies magnifica*, and/or stands that do not have a significant *Carex exserta* understory. NRI data suggests this is a heterogeneous lot with some plots fitting into Potter's *P. contorta* woodland and others representing a higher elevation form not included in the original Potter sample array **= Sierra Lodgepole Pine Woodland [*Pinus contorta* var. *murrayana* Woodland] (Potter, 1998 in part) (n=22)**

100A.2Ba.1c.4 *Pinus contorta* var. *murrayana* conspicuous emergent tree or shrubby krummholz over scattered herbaceous understory with mountain pride (*Penstemon newberryi* ssp. new*berryi*), or other rock outcrop species such as *Streptanthus tortuosus, Holodiscus discolor, or Spiraea densiflora*) usually rocky outcrops with poor soil development. Trees usually greater than 2 percent and less than 10 percent absolute cover **= Sierra Lodgepole Pine /Mountain Pride Woodland [*Pinus contorta* var. *murrayana*/*Penstemon newberryi* Woodland] (n=5)**

100A.2Ba.1c.5 Intermittent to continuous cover of *P. contorta* ssp. *murrayana* over relatively sparse to moderate, largely herbaceous understory with *Carex rossii* present and characteristic, generally of upland and slopes. Note: This is analogous to the upward extension of Potter's (1998) Sierra lodgepole pine forest (see above) where *Abies magnifica* is not present **= Sierra Lodgepole Pine/Ross Sedge Forest [*Pinus contorta* var. *murrayana/Carex rossii* Forest] (n=4)**

100A.2Ba.1c.6 Open to intermittent cover of *P. contorta* over variable sparse to moderate cover of *Carex exserta* (shorthair sedge) generally covering greater than 5 percent of the understory. May occur in slightly moister and lower slope position than previous *P. contorta/Carex rossii* Forest, but also may be on upper slopes in settings with intermittent rock outcrops and gravelly benches and slopes, where *C. exserta* may colonize **= Sierra Lodgepole Pine/Shorthair Sedge**

**Forest [*Pinus contorta* var. *murrayana*/ *Carex exserta* Forest] (n=5)**

100A.2Ba.1c.7 *Pinus contorta* var. *murrayana* is joined by *Pinus monticola* with more than 30% relative cover of *Pinus monticola*. Generally on upper slopes and ridges at moderate to high elevations = **Western White Pine-Sierra Lodgepole Pine/Western Needlegrass Woodland [*Pinus monticola-Pinus contorta* var. *murrayana/Achnatherum occidentale* Woodland] (n=30)**

**100A.2.Ba.2 Vegetation primarily of subalpine Zone IV. *Pinus albicaulis* (whitebark pine) either dominant or conspicuous species in the canopy (if *Pinus albicaulis* [whitebark pine] <50% relative cover, see *Pinus contorta* var. *murrayana* Alliance). May have *Tsuga mertensiana* in similar cover; *P. contorta* may be present (usually <1% but may codominate), generally open to intermittent cover of trees** = II.A.4.N.a.33 *PINUS ALBICAULIS* WOODLAND ALLIANCE

**These associations are arranged in order from mesic to xeric.**

100A.2Ba.2a An open to intermittent woodland association of high elevation snow accumulation sites usually below ridgelines and upper slopes on northerly exposures (may occur in sheltered microclimates on southerly exposures). Always has *Tsuga mertensiana* greater than 1 percent, though cover is variable, sometimes patchy; either species may dominate, may have some *Pinus contorta,* though generally less important than the other two conifers. This category includes all mixes of *P. albicaulis* and *T. mertensiana,* where both species are conspicuous = **Whitebark Pine-Mountain Hemlock Forest [*Pinus albicaulis Tsuga mertensiana* Forest] (n=28)**

100A.2Ba.2b Generally on gradual slopes at mid or lower positions adjacent to meadows and bench/rock outcrop systems, *Tsuga mertensiana* absent or inconspicuous, trees may be krummholz or erect. (See Sierra lodgepole pine-Whitebark pine/Shorthair sedge for comparison.) = **Whitebark Pine/Shorthair Sedge Woodland [*Pinus albicaulis/Carex exserta* Woodland] (n=9)**

100A.2Ba.2c *P. albicaulis* forms woodland or forest on lower to mid slopes, generally not krummholz; *Carex rossii* one of the few constant understory species but may be sparse; *Poa wheeleri* may be present **= Whitebark Pine/Ross Sedge Woodland [*Pinus albicaulis/Carex rossii Woodland*] (n=5)**

100A.2Ba.2e Xeric rocky upper slope krummholz association with scattered or clumped *Pinus albicaulis* over a sparse understory including *Penstemon davidsonii.* This is the standard tree line association in much of the study area. *P. davidsonii* is generally in low cover and only in rockier more sheltered settings, further sampling required to clarify other potential tree line associations = **Whitebark Pine/(Davidson's Penstemon) Woodland [*Pinus albicaulis/(Penstemon davidsonii*) Woodland] (Taylor, 1984) (n=2)**

100A.2Ba.3 Vegetation of chaparral and oak woodland Zone I stands dominated by *Pinus attenuata* (knobcone pine) in the tree layer, may have dense chaparral shrub understory, stands usually on upper slopes and ridgelines = **II.A.4.N.a.10 *PINUS ATTENUATA* WOODLAND ALLIANCE**

100A.2Ba.3a *Pinus attenuata* forms open to relatively dense canopy over *Adenostoma fasciculatum* (chamise). No plots but repeatable, clearly identifiable signature in photos, may include *Ceanothus cuneatus* (buckbrush) **= Knobcone Pine/Chamise Woodland [*Pinus attenuata/Adenostoma fasciculatum* Woodland]**

100A.2Ba.3b *Pinus attenuata* forms open to relatively dense canopy over *Arctostaphylos viscida* = **Knobcone Pine/Whiteleaf Manzanita Woodland [*Pinus attenuata/Arctostaphylos viscida* Woodland] (n=3)**

100A.2Ba.3c *Pinus attenuata* shares canopy with *Quercus chrysolepis* tends to be on upper n facing slopes in zone 2. (n=0)

100A.2Ba.4 *Pinus flexilis* (limber pine) dominant canopy tree. May form open woodlands or krummholz. Only locally known from Zone VII above Lundy Canyon, above Agnew Lake in the Rush Creek drainage, high on the south wall of Buckeye Canyon, and near Ellery Lake on east side of crest. Some stands appear to be suffering from insect or disease damage = **II.A.4.N.a.42 *PINUS FLEXILIS* WOODLAND ALLIANCE** present only on east side, no plots

100A.2Ba.5 Stands dominated by the widespread and common middle and upper montane xerophytic *Pinus jeffreyi* (Jeffrey pine), or in some cases, *P. jeffreyi* may be an important codominant with other tree species including *Abies concolor, A. magnifica*, and *Juniperus occidentalis* ssp. *australis*. Stands occur on both west and east sides of the crest primarily in ZONEs III, VII, and VIII, but exceptionally low stands may occur in Zone II on steep well drained, rocky sites **= II.A.4.N.a.43 *PINUS JEFFREYI* WOODLAND ALLIANCE (or in some cases; *Juniperus occidentalis* ssp. *australis* alliance)**

**100A.2Ba.5a Stands typically of the east side of the crest in Zones VII and VIII**

100A.2Ba.5a.1 *Pinus jeffreyi* with other conifers important (> 1% absolute cover) in the canopy or subcanopy

100A.2Ba.5a.1a *Pinus jeffreyi* mixes with *Pinus monophylla* (singleleaf pinyon) usually in concavities and semiriparian settings **= Jeffrey Pine-Singleleaf Pinyon Pine Woodland [*Pinus jeffreyi-Pinus monophylla* Woodland] (n=3)**

100A.2Ba.5a.1b *Pinus jeffreyi* mixes with *Abies concolor* and Great Basin shrubs and herbs in the understory; the typical Jeffrey pine-White fir woodland of Zone VIII on northerly slopes and in canyons **= Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland [*Pinus jeffreyi-Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland] (n=3)**

100A.2Ba.5a.1c *Pinus jeffreyi* typically dominates and mixes with *Abies concolor* and westside species of trees shrubs and herbs including *Quercus kelloggii, Calocedrus decurrens*, and *Pteridium aquilinum* = **Jeffrey Pine-White Fir Woodland [*Pinus jeffreyi-Abies concolor* Woodland] (n=39)**

100A.2Ba.5a.1c *Pinus jeffreyi* may marginally dominate in sparsely wooded stands with *Juniperus occidentalis* ssp. *australis* (Sierra juniper) also conspicuous in the tree layer **= Sierra Juniper**

**Woodland [*Juniperus occidentalis* ssp. *australis* Woodland] (Potter, 1998) (n=41)**

100A.2Ba.5a.2 *Pinus jeffreyi* usually sole conifer in tree layer

100A.2Ba.5a.2a *Pinus jeffreyi* forms a woodland over *Purshia tridentata* (antelope bitterbrush) and other Great Basin shrubs, generally of less sheltered and steep sites than previous (100A.2Ba.5a.1b) **= Jeffrey Pine/Antelope Bitterbrush Woodland [*Pinus jeffreyi/Purshia tridentata* Woodland] (Taylor, 1980) (n=4)**

100A.2Ba.5a.2b *Pinus jeffreyi* forms an open canopy over an open to relatively dense tall shrub or low tree layer of *Cercocarpus ledifolius* (curl-leaf mountain mahogany). Usually of rocky slopes in Zones VII–VIII transition = **Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland [*Pinus jeffreyi-Cercocarpus ledifolius* Woodland] (n=5)**

**100A.2Ba.5b Stands typically of the west side of the crest in Zones II and III**

100A.2Ba.5b.1 *Pinus jeffreyi* dominant with sclerophyllous shrubs (chaparral and montane chaparral species) or smaller trees (*Quercus chrysolepis*) in the understory (*Abies concolor* may contribute up to approximately 15% relative cover and *Abies magnifica* may contribute up to about 20% relative cover. If Abies concolor and *Pinus lambertiana* are both important, see Abies concolor-Pinus lambertiana Alliance)

100A.2Ba.5b.1a *Pinus jeffreyi* in the overstory with *Quercus chrysolepis* (canyon live oak) as a subcanopy tree and *Arctostaphylos viscida* (whiteleaf manzanita) as a conspicuous shrub, the lowest elevation (4,500–5,500 feet) form of the alliance on the west slope (ecological Zone II), usually on glaciated granitic slopes with outcrops = **Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland [*Pinus jeffreyi-Quercus chrysolepis/ Arctostaphylos viscida* Woodland] (n=5)** Note: At ca. 4,700 feet in the Cherry Lake area, there are stands intermediate between this association and the following (100A.2Ba.5b.1b) with open *P. jeffreyi* over low *Q. chrysolepis* with both *A. patula* and *A. viscida* in the understory. These have not been sampled.

100A.2Ba.5b.1b *Pinus jeffreyi* over *Arctostaphylos patula* (greenleaf manzanita). Usually a Zone III type of rocky areas typically more xerophytic than the *P. jeffreyi/ Q. vaccinifolia* Woodland (100A.2Ba.5b.1c) **= Jeffrey Pine/Greenleaf Manzanita Woodland [*Pinus jeffreyi/Arctostaphylos patula* Woodland] (Potter, 1998) (n=17)** Note: Where *Arctostaphylos patula* and *Quercus vaccinifolia* both at least 30% relative cover, typically mapped as *P. jeffreyi*/*Q. vaccinifolia*.

100A.2Ba.5b.1c *Pinus jeffreyi* over the shrub *Quercus vaccinifolia* (huckleberry oak), a Zone II–III transition type often with rock outcrops and may have other tree species such as *Quercus kelloggii, Abies concolor,* or *Calocedrus decurrens* in low cover = **Jeffrey pine/Huckleberry oak [*Pinus jeffreyi/Quercus vaccinifolia* Woodland] (Potter, 1998) (n=24)**

100A.2Ba.5b.1d *Pinus jeffreyi* over *Ceanothus cordulatus* (whitethorn ceanothus). A Zone III type, usually on more well developed soils than previous association (100A.2Ba.5b.1c) = **Jeffrey Pine/Whitethorn Ceanothus Woodland [*Pinus jeffreyi/Ceanothus cordulatus* Woodland] (Potter, 1998)**

100A.2Ba.5b.1e *Pinus jeffreyi* over *Chrysolepis sempervirens* (bush chinquapin). An association of ecological Zone III **= Jeffrey Pine/Bush Chinquapin Woodland [*Pinus jeffreyi/Chrysolepis sempervirens* Woodland] (Talley, 1978) (n=4)**

100A.2Ba.5b.2 *Pinus jeffreyi* mixes with either *Abies concolor* (white fir) (greater than 15% relative cover) or *A. magnifica* (California red fir) (greater than 20% relative cover) in canopy, generally open to intermittent canopy woodlands, if either fir species dominates or codominate and canopy is relatively dense, go to California red fir-White fir alliance (100A.2Bb.3c)

100A.2Ba.5b.2a *Abies magnifica* and *P. jeffreyi* form mixed canopy stands, typically *P. jeffreyi* dominates the stand **= Jeffrey Pine-California Red Fir Woodland [*Pinus jeffreyi-Abies magnifica* Woodland] (Potter, 1998) (n=15)**

100A.2Ba.5b.2b *Abies concolor* and *P. jeffreyi* form mixed canopy stands, typically *P. jeffreyi* dominates the stand **= Jeffrey Pine-White Fir Woodland] [*Pinus jeffreyi-Abies concolor* Woodland] (n=42)**

**100A.2Ba.6 Stands dominated in the short tree layer by *Pinus monophylla* (single leaf pinyon pine). If *Pinus jeffreyi* or *Juniperus occidentalis* ssp. *australis* is important, go to 100A.2Ba.5a.1a (Jeffrey pine alliance) or 100A.2Bc.2 (Sierra juniper alliance). A characteristic alliance of the east side of the crest in Zones VII7 and VIII =** II.A.4.N.a.45 *PINUS MONOPHYLLA* WOODLAND ALLIANCE

100A.2Ba.6a *Pinus monophylla* shares canopy or forms slightly taller layer over tall shrubs of *Cercocarpus ledifolius* (curl-leaf mountain mahogany). Understory has *Artemisia tridentata* and *Purshia tridentata* = **Singleleaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big Sagebrush-Antelope Bitterbrush Woodland [*Pinus monophylla-Cercocarpus ledifolius/Artemisia tridentata-Purshia tridentata* Woodland] (n=4)**

100A.2Ba.6b *Pinus monophylla* dominant overstory over Great Basin shrubs including *Ribes velutinum* (desert gooseberry) = **Singleleaf**

**Pinyon Pine/Desert Gooseberry Woodland [*Pinus monophylla/Ribes velutinum* Woodland] (n=9)**

Note: May be synonymous with * *Pinus monophylla/Symphoricarpos rotundifolia–Ribes velutinum* (usually with at least some *Artemisia tridentata*) (n=3) This is a true woodland with up to 60 percent cover of *P. monophylla* defined from Mojave (Keeler–Wolf and Thomas, 2000).

100A.2Ba.6c A poorly described association with *Pinus monophylla* over *Artemisia tridentata* with *Elymus elymoides* (squirreltail), without the two characteristic species of the above associations = **Singleleaf Pinyon Pine/Big Sagebrush/Squirreltail Woodland [*Pinus monophylla/Artemisia tridentata/Elymus elymoides* Woodland] (n=2)**

Note: May be synonymous with *Pinus monophylla/Artemisia tridentata* (n=5) in USNVC. This is a woodland of the Mojave desert and the USNVC with tree cover averaging more than 25 percent (Keeler–Wolf and Thomas, 2000)

**100A.2Ba.7 Stands dominated (>60% relative cover) in tree layer by *Pinus monticola* (western white pine) or at least 30% relative cover *P. monticola* with other pines. If other conifers are present in greater than 30 percent relative cover, look in lodgepole, California red fir, or mountain hemlock alliances. Woodlands of the subalpine and montane Zones III, IV, and VII, generally local and not extensive** = II.A.4.N.a.34 *PINUS MONTICOLA* WOODLAND ALLIANCE

100A.2Ba.7a Only one association formally defined with *Pinus monticola* and *Pinus contorta var. murrayana* (Sierra lodgepole pine) forming an open canopy over typically sparse ground cover that typically includes western needlegrass. = **Western White Pine-Sierra Lodgepole Pine/Western Needlegrass Woodland [*Pinus monticola-Pinus contorta* var. *murrayana/Achnatherum occidentale* Woodland] (n=30)**

**100A.2Ba.8 *Pinus ponderosa* (ponderosa pine) the principal canopy species usually greater than 10 percent cover. Locally, *Quercus kelloggii* (California black oak) is present, but usually substantially lower cover than *P. ponderosa.* Usually forms open woodlands over shrubs and grasses in the interface between Zones I and II. If *Calocedrus* is present greater than 1 percent, then go to 100A.2Ba.9** = II.A.4.N.a.32 *PINUS PONDEROSA* WOODLAND ALLIANCE

Only one association formally defined with *Pinus ponderosa* and *Quercus kelloggii* forming an open canopy over open to relatively dense *Arctostaphylos viscida* (whiteleaf manzanita) along with other shrubs and herbaceous species of Zones I and II. May have *Quercus wislizeni*, *Pinus lambertiana*, *Pinus attenuata*, and *Pinus sabiniana* in small amounts in canopy and *Chamaebatia foliolosa* (mountain misery) and annual *Bromus* sp. in understory **= Ponderosa Pine/California Black Oak/Whiteleaf Manzanita Woodland [*Pinus ponderosa/Quercus kelloggii/ Arctostaphylos viscida* Woodland] (n=5)**

100A.2Ba.9 *Pinus ponderosa* (ponderosa pine) and *Calocedrus decurrens* (incense cedar) both important (> 1% cover) in canopy and/or regeneration layers. Other conifers such as *Abies concolor* and *Pinus lambertiana* may be present, but combined, *P. ponderosa* and *C. decurrens* comprise the most cover = **I.A.8.N.b.?? *PINUS PONDEROSA-CALOCEDRUS DECURRENS* FOREST ALLIANCE (NEW)**

100A.2 Ba.9a. *Quercus chrysolepis* (canyon live oak) conspicuous in stand. May or may not have *Quercus kelloggii* in tree layer.

100A.2 Ba.9a.1 Stands defined by overstory of *Pinus ponderosa* and *Calocedrus decurrens* with presence of *Quercus chrysolepis* and sparse to dense understory of *Chamaebatia foliolosa*. May have other shrubs such as *Arctostaphylos patula* **= Ponderosa Pine-Incense Cedar-Canyon Live Oak/Mountain Misery Woodlands [*Pinus ponderosa-Calocedrus decurrens-Quercus chrysolepis/Chamaebatia foliolosa* Woodland] (n=5)**

100A.2Ba.9b *Quercus chrysolepis* absent or unimportant (< 1%), *Quercus kelloggii* (California black oak) or no oaks conspicuous in stand

100A.2Ba.9b.1 *Pinus ponderosa* and *Calocedrus decurrens* are dominant and average about 60 percent crown cover; *Quercus kelloggii* present, generally in low cover, throughout stand; may include some *Pinus lambertiana* (sugar pine) at upper elevation extents of type. *Chamaebatia foliolosa* usually absent or inconspicuous **= Ponderosa Pine-Incense Cedar-California Black Oak Woodland [*Pinus ponderosa-Calocedrus decurrens-Quercus kelloggii* Woodland] (n=32)**

100A.2Ba.9b.2 Stands are generally more open than above with scattered to dense understory of *Chamaebatia foliolosa;* may have conspicuous scattered shrubs of *Arctostaphylos patula*, or scattered low herbs of *Galium bolanderi*; may have significant *Pinus lambertiana* in canopy along with other two conifers, generally at coolest (high elevation) extreme of this alliance **= Ponderosa Pine-Incense Cedar/Mountain Misery Woodland [*Pinus ponderosa-Calocedrus decurrens/Chamaebatia foliolosa* Woodland] (n=3)**

**100A.2Ba.10 *Pinus sabiniana* (gray pine) forms an open overstory generally greater than 10 percent over the variable understory that may include shorter broadleaf trees, shrubs, herbs, and grasses. If *Quercus wislizeni* conspicuous or important, see also *Quercus wislizeni* Woodland Alliance. Generally xeric stands of ecological Zone I** = II.A.4.N.a.27 *PINUS SABINIANA* WOODLAND ALLIANCE

Note: This is a variable alliance in the study area with insufficient plot data to define more than two associations. Aside from the types identified in the key below, some additional variations as indicated by individual plots include stands with woody understories with *Umbellularia, Cercocarpus betuloides, Pseudotsuga menziesii,* and *Quercus kelloggii.* Stands may occur on dry slopes or in riparian terraces and flats. Other sparse stands with annual grass understories also exist.

100A.2Ba.10a *Pinus sabiniana* forms an overstory above the small tree *Quercus wislizeni* (interior live oak) and the shrub *Ceanothus cuneatus* (buckbrush) = **Gray Pine-Interior Live Oak/BuckbrushWoodland [*Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* Woodland] (n=4)**

100A.2Ba.10b *Pinus sabiniana* with *Quercus wislizeni* over the shrub *Adenostoma fasciculatum* (chamise) **= Gray Pine-Interior Live**

**Oak/Chamise Woodland [*Pinus sabiniana-Quercus wislizeni/Adenostoma fasciculatum* Woodland]** (no plots but consistently interpretable air photo signature, defined as informal mapping unit at this time)

100A.2Ba.10c *Pinus sabiniana* with *Quercus wislizeni* over *Arctostaphylos viscida* (whiteleaf manzanita) = **Gray Pine-Interior Live Oak/Whiteleaf Manzanita Woodland [*Pinus sabiniana-Quercus wislizeni/Arctostaphylos viscida* Woodland] (n=4)**

100A.2Ba.10d A poorly defined type with *Pinus sabiniana* over *Arctostaphylos viscida* with no *Quercus wislizeni* **(n=2)**

100A.2Ba.10e *Quercus douglasii* (blue oak) dominates in canopy with lesser (< 10 percent on average across stand) cover of emergent *Pinus sabiniana* over a grassy understory = **Blue Oak-Gray Pine/Grass (*Quercus douglasii-Pinus sabiniana*/Grass) (Allen et al., 1991) (n=2)** of the ***Quercus douglasii* alliance;** see also 100B.1Bb.2a

100A.2Bb One or more fir species (*Abies* spp.) is important in the coniferous canopy.

**100A.2Bb.1 *Abies concolor* (white fir) strongly dominant (> 60% relative cover) in canopy and most common tree species in reproduction layers; may be mixed with other conifer species, but if *Pinus lambertiana* (sugar pine) present it covers less than 1 percent** = I.A.8.N.b.?? *ABIES CONCOLOR* FOREST ALLIANCE **(Note: This alliance has been defined for other parts of California, but all plots with white fir dominant in Yosemite environs also have sugar pine and are probably best considered in White fir–Sugar pine alliance [see 100A.2Bb.2].)**

100A.2Bb.2 *Abies concolor* (white fir) usually dominant, but mixed in canopy with sugar pine (*Pinus lambertiana*) at least 5 percent cover. Incense cedar may also be present in high cover. Ponderosa pine and/or Jeffrey pine may be present but usually with lower cover than the previous species = **I.A.8.N.b.?? *ABIES CONCOLOR-PINUS LAMBERTIANA* ALLIANCE (NEW)**

Note: Several associations formerly classed in the White fir alliance (White fir–Pacific dogwood/American trail plant Association [former photointerpretation code 4082] White fir/False Solomon's-seal-Drops of Gold Association [former code 4083] White fir-Sugar pine-Jeffrey pine) have been moved to White fir-Sugar pine alliance (100A.2Bb.2). There are some stands with dense *A. concolor* and essentially no understory (e.g., Wieslander 476 and 597) that may be borne out as a white fir association with further data.

100A.2Bb.2a *Abies concolor*, *Pinus lambertiana*, and *Calocedrus decurrens* all present over 5 percent cover in canopy. Associations arranged from most mesic to xeric.

100A.2Bb.2a.1 Understory with both *Corylus cornuta* (California hazel) and *Cornus nuttalli* (mountain dogwood), may have *Adenocaulon bicolor* (American trail plant). Generally mesic lower slope settings, some stands are semiriparian with scattered *Alnus rhombifolia* (white alder) = **White Fir-Sugar Pine-Incense Cedar/Pacific Dogwood/ California Hazel Forest [*Abies concolor-Pinus lambertiana-Calocedrus decurrens/Cornus nuttalli/Corylus cornuta* var. *californica* Forest] (n=3+1)**

100A.2Bb.2a.2 Understory without regular occurrence of *Corylus* or *Cornus* but with scattered clusters of *Adenocaulon*

*bicolor* (American trail plant). Canopy cover relatively high, soil usually moderately deep. Generally less mesic (mid slope or less sheltered positions) than previous type = **White Fir-Sugar Pine-Incense Cedar/American Trail Plant Forest [*Abies concolor-Pinus lambertiana-Calocedrus decurrens/Adenocaulon bicolor* Forest] (=Fites 1993 ABCO-MCN/ADBI) (n=7)**

100A.2Bb.2a.3 Generally moderately open forest in mid or lower slope positions with understory characterized by the creeping viny shrub *Symphoricarpos mollis* and the low herb *Kelloggia galloides*. Moisture conditions usually somewhat drier than previous associations **= White Fir-Sugar Pine-Incense Cedar /Creeping Snowberry/Milky Kelloggia Forest [*Abies concolor-Pinus lambertiana-Calocedrus decurrens/ Symphoricarpos mollis/Kelloggia galloides* Forest] (=Fites 1993 ABCO-MCN/SYMO/KEGA) (n=7)**

100A.2Bb.2a.4 A moderately open forest in relatively dry settings (upper slopes or southerly exposures) understory with regular occurrence of *Chrysolepis sempervirens* (bush chinquapin) and scattered clumps of *Carex multicaulis* (multistemmed sedge) = **White Fir-Sugar Pine-Incense Cedar/Bush Chinquapin/ Multistemmed Sedge Forest [*Abies concolor-Pinus lambertiana-Calocedrus decurrens/Chrysolepis sempervirens/Carex multicaulis* Forest] (=Fites 1993 ABCO-MCN/CHSE2) (n=13)**

100A.2Bb.2b *Abies concolor* and *Pinus lambertiana* principal canopy species. Without significant cover of *Calocedrus* (less than 5 percent in canopy or understory) but may have other conifers such as *Pinus jeffreyi*. These associations are arranged from mesic to xeric.

100A.2Bb.2b.1 *Abies concolor* dominant in dense forest with lower cover of *Pinus lambertiana*. Mesic sparse understory includes presence of *Disporum hookeri* and *Maianthemum racemosa* not particularly common in area and may locally be just as mesic phase of the *Abies concolor-Pinus lambertiana-Calocedrus decurrens/Adenocaulon bicolor* Forest (100A.2Bb.2a.2) **= White Fir-Sugar Pine/False Solomon's-seal-Drops of Gold Forest [*Abies concolor-Pinus lambertiana/ Maianthemum racemosa-Disporum hookeri* Forest] (Fites, 1993) (n=4)**

100A.2Bb.2b.2 *Abies concolor* and *Pinus lambertiana* are sole dominants in overstory, either may be the major species, both are usually over 20 percent relative cover. Canopy can also have lesser amounts of *Pinus ponderosa* and *Quercus kelloggii*. Forests are typically dense and are midslope or more mesic upper slope positions, with little distinction in understory = **White Fir–Sugar Pine Forest [*Abies concolor-Pinus lambertiana* Forest] (n=11)**

100A.2Bb.2b.3 *Abies concolor* dominant in the canopy including young trees over dense to open shrub layer dominated by *Ceanothus cordulatus* (whitethorn ceanothus). *Pinus lambertiana* is present (either in regeneration layer, canopy, or both) but usually much less important than *A. concolor*. Generally a recent post fire or post logging (outside

of park) association **= White Fir-Sugar Pine/Whitethorn Ceanothus Forest [*Abies concolor-Pinus lambertiana/Ceanothus cordulatus* Forest] (n=4)**

100A.2Bb.2b.4 *Abies concolor, Pinus lambertiana,* and *Pinus jeffreyi* are all significant components of the canopy (*P. jeffreyi* may range from 2% to 25%). Stands can have shrubby understory including *Ceanothus cordulatus* and *Chrysolepis sempervirens.* Generally open forests of upper slopes or relatively dry exposures = **White Fir-Sugar Pine-Jeffrey Pine Forest [*Abies concolor-Pinus lambertiana-Pinus jeffreyi* Forest] (n=18)**

100A.2Bb.3 *Abies magnifica* (California red fir) and *Abies concolor* (white fir) conspicuous, both greater than 15 percent relative cover in canopy, either may dominate. Stands generally occur in cooler and/or more mesic settings than White fir or White fir-sugar pine alliances **= I.A.8.N.c. ?? CALIFORNIA RED FIR-WHITE FIR ALLIANCE (Parker, 1984; Parker, 1982)**

Associations are arranged from mesic to xeric.

100A.2Bb.3a *Abies concolor, Pinus lambertiana,* and *Abies magnifica* are present, usually with the first two species dominant. Typically located upward in elevation from slightly warmer *Abies concolor-Pinus lambertiana* Forest **= White Fir-Sugar Pine-California Red Fir Forest [*Abies concolor-Pinus lambertiana-Abies magnifica* Forest (Potter, 1998) (n=14) (Note: Potter's name retained for this association in the California Red Fir-White Fir Alliance)**

100A.2Bb.3b *Abies magnifica* and *Abies concolor* typically only canopy species, either may dominate (both at least 10% relative cover). Ranges over a variety of slope positions and exposures depending on elevation. Typically largest stands are on midslopes in somewhat mesic settings = **California Red Fir-White Fir Forest [*Abies magnifica-Abies concolor* Forest] (Potter, 1998) (n=23)**

100A.2Bb.3c Either *Abies magnifica* or *A. concolor* may be dominant, with *Pinus jeffreyi* important (> 5 percent relative cover) in stand. Relatively xeric locations (shallow soils on upper slopes or on sunny slope exposures) **= California Red Fir-White Fir-Jeffrey Pine Forest [*Abies magnifica-Abies concolor-Pinus jeffreyi* Forest] (Potter, 1998) (n=11)**

100A.2Bb.4 *Abies magnifica* dominant overstory tree and present in reproduction layers. May include several other tree conifers in stand, but white fir, sugar pine, and other warmer climate species (typically from lower elevations) are unimportant (< 5% relative cover) **= I.A.8.N.c.26 *ABIES MAGNIFICA* FOREST ALLIANCE**

100A.2Bb.4a *Abies magnifica* and *Pinus monticola* (western white pine) only trees in canopy, both important (> 1 % cover) in canopy, generally with *A. magnifica* dominant. The following associations are arranged in order of mesic to xeric.

100A.2Bb.4a.1 *A. magnifica* and *P. monticola* form moderately closed forest with no characteristic understory species. Usually on relatively mesic and shaded mid and upper slopes **= California Red Fir-Western White Pine Forest [*Abies magnifica-Pinus monticola* Forest] (Potter, 1998) (n=25)**

100A.2Bb.4a.2 *A. magnifica* and *P. monticola* form a more open canopy than previous type, with small to moderately large light gaps having understory of *Arctostaphylos nevadensis* (pinemat manzanita). Usually on upper slopes and ridges, but somewhat less exposed or xeric than following association = **California Red Fir-Western White Pine/Pinemat Manzanita Forest [*Abies magnifica-Pinus monticola/Arctostaphylos nevadensis* Forest] (Potter, 1998) (n=10)**

100A.2Bb.4a.3 *A. magnifica* and *P. monticola* form moderately open canopy with understory openings occupied by shrubs of *Chrysolepis sempervirens* (bush chinquapin). Often on southerly exposures within the upper California red fir zone = **California Red Fir-Western White Pine/Bush Chinquapin Forest [*Abies magnifica/Chrysolepis sempervirens* Forest] (Potter, 1998) (n=4)**

100A.2Bb.4a.4 *A. magnifica* and *P. monticola* form moderately open canopy with understory openings dominated by shrubs of *Quercus vaccinifolia* (huckleberry oak). Probably closely related to the above 100A.2Bb.4a.2 and 100A.2Bb.4a.3 but other shrubs substantially less important than in those associations. Usually of more xeric (southerly) exposures near crests of ridges. Not a formally defined type but observed in several sites in ZONEs III and IV. = **California Red Fir-Western White Pine/Huckleberry Oak Forest [*Abies magnifica/Quercus vaccinifolia* Forest] (undescribed preliminary type)**

100A.2Bb.4b *Abies magnifica, Pinus monticola,* and/or *Pinus contorta* var. *murrayana* present in canopy.

100A.2Bb.4b.1 *Abies magnifica, P. monticola*, and *P. contorta* var. *murrayana* present in the canopy throughout the stand, generally with *A. magnifica* as major dominant and two pines as subordinate. Found on lower slopes and on protected midslopes throughout much of the California red fir belt = **California Red Fir-Western White Pine-Sierra Lodgepole Pine Forest [*Abies magnifica-Pinus monticola-Pinus contorta* var. *murrayana* Forest] (Potter, 1998) (n=30)**

100A.2Bb.4b.2 *A. magnifica* and *P. contorta* are principal canopy species, *Pinus monticola* absent or of very low importance (< 1% cover). Forest moderately dense and productive with insignificant shrub layer and scattered individuals of *Hieracium albiflorum* (whiteflower hawkweed) and a few other herbs; shrubs unimportant. Widespread often adjacent to and immediately upslope from more mesic associations of the mapping area within the upper red fir belt = **California Red Fir-Sierra Lodgepole Pine/Whiteflower Hawkweed Forest [*Abies magnifica-Pinus contorta* var. *murrayana/Hieracium albiflorum* Forest] (Potter, 1998) (n=19)**

100A.2Bb.4c *Abies magnifica* sole species in canopy or other trees species other than above (such as *Juniperus occidentalis* ssp. *australis*) may be present in small numbers, particularly in understory. These associations are ordered from mesic to xeric.

100A.2Bb.4c.1 *A. magnifica* is sole dominant and forms moderately dense to dense forests. Usually with deep litter and very little understory vegetation. May occur on many slope exposures depending on elevation, usually on fairly well developed soil = **California Red Fir Forest [*Abies magnifica* Forest] (Potter, 1998) (n=37)**

100A.2Bb.4c.2 *A. magnifica* sole dominant over relatively open understory with *Arctostaphylos nevadensis* (pinemat manzanita) characteristic. Usually on shallow soils of upper slopes and ridges = **California Red Fir/Pinemat Manzanita Forest [*Abies magnifica/ Arctostaphylos nevadensis* Forest] (Potter, 1998) (n=5)**

100A.2Bb.4c.3 *A. magnifica* forms open overstory over relatively xeric understory dominated or characterized by *Wyethia mollis* (woolly mule-ears), but with several other herbaceous and subshrub species. Usually on volcanic mudflow deposits (locally at northern end of the mapping area) = **California Red Fir/Woolly Mule-ears Forest [*Abies magnifica/Wyethia mollis* Forest] (Potter, 1998) (n=0)** No samples within study area, but verified visually from N portion on volcanic lahars

100A.2Bc A species in the cypress family (*Calocedrus decurrens*, *Juniperus occidentalis* ssp. *australis*) is dominant or conspicuous conifer in the canopy. Note that *Juniperus* is a strong indicator of xeric and rocky settings. Other conifers such as *Pinus jeffreyi*, *Abies magnifica*, and *A. concolor* may be present in near equal amounts to *J occidentalis*. However, *J. occidentalis* alliance criteria are still met when it is only a codominant.

100A.2Bc.1 *Calocedrus decurrens* dominant and/or conspicuous conifer in canopy. The winter deciduous tree *Alnus rhombifolia* is usually present in local stands and may dominate immediately adjacent to streams and seeps; typically stands occur in riparian or semiriparian settings on the west side of the crest within ecological Zones II and III **= I.A.8.N.c. ?? *CALOCEDRUS DECURRENS* FOREST ALLIANCE**

100A.2Bc.1a *Calocedrus* and *Alnus* are principal trees in the stand; may also include scattered *Abies concolor* and *Pseudotsuga menziesii*. Understory may include *Cornus nuttalli* and *Rhododendron occidentalis*. Stands occupy bottoms and terraces adjacent to streams or other wetlands = **Incense Cedar-White Alder Forest [*Calocedrus decurrens-Alnus rhombifolia* Forest] (Potter, 2000 ms) (n=6)**

100A.2Bc.2 *Juniperus occidentalis* ssp. *australis* (Mountain or Sierra juniper) conspicuous tree; usually covers less than 30 percent (and down to 2% absolute cover when its relative cover is high) of the stand over sparse to intermittent shrubby or herbaceous understory; associated with rocky slopes on both sides of the crest in ecological Zones III, IV, and VII. May occur with additional conifers in low cover, particularly *Pinus jeffreyi*, *Abies concolor*, and/or *Abies magnifica* = **II.A.4.N.a.37 *JUNIPERUS OCCIDENTALIS* ssp. *AUSTRALIS* WOODLAND ALLIANCE**

100A.2Bc.2a Stands largely of the west side without *Artemisia tridentata* or *Cercocarpus ledifolius* as significant components. Widespread on sunny, exposed granitic (usually high bedrock %) slopes and ridges **= Sierra Juniper Woodland [*Juniperus occidentalis* ssp. *australis* Woodland] (Potter, 1998) (n=41)**

Note: There is one large association that occurs largely on the west side in Zone III. Variation within has been identified, and currently, two phases as well as the general association are recognized. There are also anomalous high-elevation stands that occur in ecological Zone IV with *Pinus monticola* and *Pinus contorta* intermixing.

100A.2Bc.2a.1 A high-elevation westside phase with *Juniperus* over a relatively high cover of the matted shrub *Arctostaphylos nevadensis* **= Sierra Juniper/Pinemat Manzanita Woodland (*Juniperus occidentalis australis* ssp./*Arctostaphylos nevadensis* Woodland) phase (n=3)**

100A.2Bc.2a.2 Another phase in rocky outcrops areas where *Holodiscus discolor* (oceanspray) is the predominant shrub = **Sierra Juniper/Oceanspray Woodland Phase** (***Juniperus occidentalis* ssp. *australis*/*Holodiscus discolor* Woodland phase) (n=5)**

100A.2Bc.2b *Juniperus occidentalis* ssp. *australis* and *Cercocarpus ledifolius* (curl-leaf mountain mahogany) both conspicuous, an eastside association on relatively steep rocky slopes in Zone VII = **Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland [*Juniperus occidentalis* ssp. *australis-Cercocarpus ledifolius/Artemisia tridentata* Woodland] (n=4)**

100A.2Bc.2c *Juniperus occidentalis* ssp. *australis* forms open canopy over *Artemisia tridentata* (big sagebrush); may occur on both east and west sides of crest, but on west side usually associated with volcanics in northern portion of mapping area **= Sierra Juniper/Big Sagebrush Forest [*Juniperus occidentalis* ssp. *australis/Artemisia tridentata* Forest] (Potter, 1998) (n=6)**

100A.2Bd *Pseudotsuga menziesii* (Douglas-fir) is important in the canopy; may be mixed with other conifer species including *Pinus ponderosa*, *Calocedrus decurrens*, and *Abies concolor*. All species may codominate.

100A.2Bd.1 *Pseudotsuga menziesii* (Douglas-fir) dominant or conspicuous conifer in canopy. May be mixed with other conifers or hardwood tree species, but *Pseudotsuga* is always found as mature individual and as scattered reproduction in the stands. Stands are at the southern limits of their range in the Yosemite region and are typically limited to sheltered, mesic, and low elevation sites, often adjacent to cliff bases or watercourses within ecological Zones II or III. Insufficient data sets exist to define more than three associations, though outlier samples have been collected including two examples of a streamside type with *Alnus rhombifolia* = **I.A.8.N.c.22 *PSEUDOTSUGA MENZIESII* FOREST ALLIANCE or I.A.8.N.c. ?? *PSUEDOTSUGA MENZIESII-PINUS PONDEROSA* FOREST ALLIANCE**

Associations are listed in order of coolest to warmest ecological settings.

100A.2Bd.1a *Pseudotsuga* occurs as codominant or subdominant with *Abies concolor* and *Calocedrus decurrens* found on northerly facing bases of cliffs and slopes (e.g., Yosemite Valley, Tuolumne River drainage, near Harden Flat) = **Douglas-Fir-White Fir-Incense Cedar Forest [*Pseudotsuga menziesii-Abies concolor-Calocedrus decurrens* Forest] (n=7)**

100A.2Bd.1b *Pseudotsuga* occurs with *Pinus ponderosa* and *Calocedrus decurrens* in canopy found on lower slopes and bottoms

adjacent to streams and ravines, generally below 4,000 feet elevation in Merced River Canyon or Tuolumne River drainage, and in Harden Flat = **Douglas-fir-Ponderosa pine-Incense cedar Forest [*Pseudotsuga menziesii-Pinus ponderosa-Calocedrus decurrens* Forest] (n=5) of the *Pseudotsuga menziesii-Pinus ponderosa* Forest Alliance**

100A.2Bd.1c *Pseudotsuga* occurs with *Quercus chrysolepis* as only other major tree species on lower steep slopes and bases of cliffs. In some cases *Pseudotsuga* is emergent over a more continuous layer of *Quercus chrysolepis* **= Douglas-Fir-Canyon Live Oak Forest [*Pseudotsuga menziesii-Quercus chrysolepis* Forest] (Taylor & Teare, 1979a) (n=10)**

100A.2Bd.1d *Pseudotsuga* occurs as an overstory over *Alnus rhombifolia* (White alder). A riparian type occurring along small creeks in Zone II particularly on the Tuolumne River drainage; poorly sampled, but seen more than 10 times by photointerpreters = ***Pseudotsuga menziesii-Alnus rhombifolia* Forest (n=2)**

100A.2Be *Tsuga mertensiana* (mountain hemlock) important conifer in canopy.

100A.2Be.1 *Tsuga mertensiana* (mountain hemlock) is either dominant or important and conspicuous tree. Forests or woodlands of mesic subalpine zone. May include up to equal or higher cover of other trees such as *Abies magnifica, Pinus contorta* var. *murrayana,* or *Pinus monticola* but does not include significant cover of *Pinus albicaulis* (see *Pinus albicaulis* alliance) **= I.A.8.N.c.11 TSUGA MERTENSIANA FOREST ALLIANCE**

The following associations are arranged in order of increasing coolness of environments (e.g., all other things being equal, increasing elevation)

100A.2Be.1a *Tsuga mertensiana* common and conspicuous, may have equal or even higher cover of *Abies magnifica* in canopy, soil generally better developed (e.g., on lower slopes) and less steep (usually < 30% slope) than following association; may have *Pinus contorta* in low to moderate cover, usually less important than previous two species of conifers = **Mountain Hemlock Forest [*Tsuga mertensiana* Forest] (Potter, 1998) (n=21)**

100A.2Be.1b *Tsuga mertensiana* and *Pinus monticola* both important in canopy and understory; generally northerly facing slopes of moderate steepness or on upper slopes or ridges; tree cover is moderately dense, soils moderate to shallow = **Mountain Hemlock-Western White Pine Forest [*Tsuga mertensiana-Pinus monticola* Forest] (n=19)** Note: This is renamed and includes Potter's (1998) mountain hemlock/steep association.

100A.2Be.1c *Tsuga mertensiana* and *Pinus contorta* var. *murrayana* are the only tree species of significant cover; either may be dominant. Understory species are generally low cover and uncharacteristic. Plots included herein are Wieslander plots and tend to underrepresent understory species cover and composition. Included herein are plots formerly believed to represent the putative ***Tsuga mertensiana-Pinus contorta* var. *murrayana/Phyllodoce breweri* Forest** and the ***Tsuga mertensiana-Pinus contorta* var. *murrayana/ Carex rossii* Forest** from the preliminary classification. Because Wieslander plots cannot reliably be used to identify understory herbaceous species, these are currently lumped into this type, which may be considered a "suballiance" rather than a well-defined association. Stands occur at lower, middle, and upper slope positions and may have open to

relatively continuous overstories = **Mountain Hemlock-Sierra Lodgepole Pine Forest [*Tsuga mertensiana-Pinus contorta* var. *murrayana* Forest] (n=32)**

100A.2Be.1d *Tsuga mertensiana* and *P. contorta* var. *murrayana* are joined by *Pinus monticola* as important in the canopy. Generally rockier and more exposed than the previous three associations, upper or midslope locations = **Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Forest [*Tsuga mertensiana-Pinus contorta* var. *murrayana-Pinus monticola* Forest] (Parker, 1988) (n=23)**

100A.2Be.1e *Tsuga mertensiana* is joined by *Pinus albicaulis*, sometimes with low cover of Pinus contorta as well. Generally occurs in highest elevations and coolest sites, though stands may vary; some quite open and others with relatively high cover. These stands occur on ridges or on upper thirds of slopes, typically on northerly exposures = **Whitebark Pine - Mountain Hemlock Woodland [*Pinus albicaulis - Tsuga mertensiana Woodland*] (part of *Pinus albicaulis* alliance, see** 100A.2Ba.2a**)**

**100B Winter deciduous forests and woodlands. Winter deciduous species generally contribute greater than 50 percent of the total tree (relative) cover. However, some stands in this group are characterized by the deciduous tree being of high importance but not dominant. Some alliances are modally considered forest, but others may range down into woodland (25–60% tree cover), or even sparsely wooded shrubland or herbaceous (< 25% cover of trees). Note: If forest is codominated by both evergreen and deciduous species, go to 100C (mixed evergreen and deciduous forest).**

**100B.1. Deciduous forests (or woodlands) of uplands or marginal wetlands. Major deciduous tree species are *Populus tremuloides* or the oaks *Quercus kelloggii*, *Q. douglasii*, or *Q. lobata.* Dominant species typically not with roots or stems immediately adjacent to year-round flowing water (but see some quaking aspen stands).**

100B.1A Relatively dense to open forest or woodland with *Populus tremuloides* (quaking aspen) usually dominant (> 50% relative cover) or in the case of the quaking aspen-Jeffrey pine, or quaking aspen-Sierra lodgepole pine associations, important tree. May have mixtures of other conifers in canopy including *Abies concolor, A. magnifica, Pinus jeffreyi, P. contorta* var. *murrayana* = **I.B.2.N.b.10 *POPULUS TREMULOIDES* FOREST ALLIANCE**

100B.1Aa *Populus tremuloides* in upland settings away from immediate influence of saturated soil or flowing water (upland quaking aspen). May include up to 15% cover of Pinus monticola, P. contorta, P. jeffreyi, or Juniperus occidentalis or other conifers.

100B.1Aa.1 Understory largely xeric shrubs and herbs including relatively high cover of *Artemisia tridentata*. Primarily east of Sierra Nevada crest **= Quaking Aspen/Big Sagebrush Forest [*Populus tremuloides/Artemisia tridentata* Forest] (n=13)**

Includes a phase with more diverse shrub and herb components = **Quaking Aspen/Big Sagebrush/Mountain Monardella-Milky Kelloggia Forest (*Populus tremuloides/Artemisia tridentata/Monardella odoratissima-Kelloggia galioides* Forest) phase (n=5)**

100B.1Aa.2 *Artemisia tridentata* usually unimportant in stands, but *Monardella odoratissima* present in all stands, may be east or west of Sierra Crest = **Quaking Aspen/Mountain Monardella Forest [*Populus tremuloides/Monardella odoratissima* Forest] (Potter, 1998) (n=1)**

100B.1Ab. *Populus tremuloides* in moist stands with mesic to hydric understory species, riparian or meadow settings on east and west side of Sierra Crest.

**100B.1Ab.1 *Pinus jeffreyi* a significant component in tree and/or sapling layer, usually along narrow streams with moderate to steep gradients or upland settings adjacent to meadows east of Sierra Crest = Quaking Aspen-Jeffrey Pine Forest [*Populus tremuloides-Pinus jeffreyi* Forest] new (n=6)**

100B.1Ab.2 *Pinus contorta* var. *murrayana* important or even marginally dominant in stands, usually moderately mesic understory including *Poa pratensis* and scattered *Artemisia tridentata*. East-side meadows and low gradient creek banks = **Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest [*Populus tremuloides-Pinus contorta/Artemisia tridentata/Poa pratensis* Forest] (n=5)**

100B.1Ab.3 Conifers unimportant in stands, but riparian shrubs including *Rosa woodsii* and *Salix* spp. are significant understory. East side riparian settings = **Quaking Aspen/Woods' Rose Forest [*Populus tremuloides/Rosa woodsii* Forest] (n=6)**

100B.1Ab.4 *Veratrum californicum* and an assortment of other wetland or mesophytic herbs and grasses in understory, usually low gradient meadow edges. May be west or east of the crest = **Quaking Aspen/California False Hellebore Forest [*Populus tremuloides/Veratrum californicum* Forest] (Potter, 1998) (n=8)**

100B.1B A deciduous oak (*Quercus* sp.) the important canopy tree, may include conifers such as *Pseudotsuga menziesii, Pinus ponderosa, P. sabiniana*, or *Calocedrus decurrens*.

100B.1Ba *Quercus kelloggii* (California black oak) major tree in canopy, may have emergent (< 10%) conifers, but *Q. kelloggii* is the dominant (> 50% relative cover) throughout the stand **= I.B.2.N.b?? *QUERCUS KELLOGGII* FOREST ALLIANCE**

Note: Several stands have been sampled that show some variation in understory beyond defined associations including stands with *Pteridium aquilinum* (bracken fern), stands in rocky low elevation sites with *Aesculus californica* (California buckeye), *Cercarpus montanus* var. *glaber* (*C. betuloides*, Hickman 1993 nomenclature, birchleaf mountain mahogany), and emergent *Pinus sabiniana* (gray pine); none have sufficient sample sizes to define associations.

100B.1Ba.1 *Calocedrus decurrens* (incense cedar) present in either sapling/seedling or tree layer. May also include *Pseudotsuga menziesii* (Douglas-fir) in low cover. Widespread on west side of Sierra Crest in ecological Zone II, may be on all slope exposures depending on elevation = **California Black Oak-Incense Cedar Forest [*Quercus kelloggii-Calocedrus decurrens* Forest] (n=9)**

100B.1Ba.2 Understory with *Arctostaphylos mewukka* (Mewuk manzanita) and the subshrub *Chamaebatia foliolosa* (mountain misery), generally somewhat xeric exposures (southerly facing slopes and ridges) in ecological Zone II = **California Black Oak/Mewuk Manzanita/Mountain Misery Forest [*Quercus kelloggii/ Arctostaphylos mewukka-Chamaebatia foliolosa* Forest] (n=3)**

100B.1Ba.3 Generally xeric stands on shallow rocky soil of upper elevation extent of the alliance, may have scattered *Pinus jeffreyi* (Jeffrey pine) or other mid-elevation conifers. *Arctostaphylos patula* variable, but usually greater than 5 percent may have *Ceanothus cordulatus, Prunus emarginata*, and other montane chaparral shrubs = **California Black Oak/Greenleaf Manzanita Forest [*Quercus kelloggii/Arctostaphylos patula* Forest] (Allen et al., 1991) (n=5)**

100B.1Ba.4 Open stands of *Q. kelloggii* with a grassy or herbaceous understory with *Pteridium aquilinum* common or conspicuous. Insufficient plots for association description, but photo signature discernable and treated as a mapping

unit currently = **California Black Oak/Bracken Fern Forest [*Quercus kelloggii/Pteridium aquilinum* Forest] Mapping Unit (n=2)**

100B.1Bb *Quercus douglasii* (blue oak) dominant or conspicuous in canopy, may include other evergreen trees such as *Quercus wislizeni* (interior live oak) or *Pinus sabiniana* (gray pine) in lesser numbers. Of xeric low elevation west side, ecological Zone I = **II.B.2.N.a.14 *QUERCUS DOUGLASII* WOODLAND ALLIANCE**

100B.1Bb.1 *Quercus douglasii* sole important tree.

100B.1Bb.1a Forms a woodland over an open to intermittent shrub layer dominated by *Ceanothus cuneatus* (buckbrush), which is underlain by annual grasses and herbs = **Blue Oak/Buckbrush/Annual Grass Forest [*Quercus douglasii/Ceanothus cuneatus*/grass Forest] (Allen et al., 1991) (n=1)**

100B.1Bb.1b Forms a layer over a grassy understory including *Bromus* sp. and *Daucus pusillus* = **Blue Oak/Brome Species-American Wild Carrot Woodland [*Quercus douglasii/Bromus* spp.*-Daucus pusillus*] Woodland (n=5)**

100B.1Bb.2 *Quercus douglasii* mixes in canopy with *Pinus sabiniana* and/or *Quercus wislizeni.*

100B.1Bb.2a *Q. douglasii* dominates in canopy with lesser (< 10% on average across stand) cover of emergent *Pinus sabiniana* over a grassy understory in both lower Merced and Tuolumne River (Cherry Creek Rd., Drew Meadow) canyons. *Quercus wislizeni* generally absent or inconspicuous = **Blue Oak-Gray Pine/Grass Woodland [*Quercus douglasii-Pinus sabiniana*/grass Woodland] (Allen et al., 1991) (n=2)**

100B.1Bb.2b *Q. douglasii* and *Quercus wislizeni* present in the canopy over an annual dominated herbaceous understory. May have sparse (usually < 5%) *Pinus sabiniana* = **Blue Oak-Interior Live Oak/Brome Species-American Wild Carrot Woodland [*Quercus douglasii-Quercus wislizeni/Bromus* spp.*-Daucus pusillus* Woodland] (Allen et al., 1991) (n=6)**

100B.1Bc *Quercus lobata* (valley oak) dominant or conspicuous in canopy. May include *Q. wislizeni*, *Q. douglasii*, and/or *Q. kelloggii* in stand. Of very limited extent in study area (less than 4 stands), restricted to flats and terraces above lower Merced River channel in ecological Zone I = **II.B.2.N.a.18 *QUERCUS LOBATA* WOODLAND ALLIANCE -** no associations defined (n=3)

100B.1C *Aesculus californica* (California buckeye) dominant or conspicuous tree in stand. Usually small stands in somewhat mesic concavities on steep lower to mid slopes of Merced River Canyon associated with *Quercus wislizeni* or other oak stands = **II.B.2.N.a.2 *AESCULUS CALIFORNICA* WOODLAND ALLIANCE**

No well-defined associations. Only two plots sampled; suggests rocky sites with *Lupinus albifrons* or moist sites with *Datisca glomerata*.

**100B.2. Deciduous forests or woodlands of wetlands, typically temporarily flooded by flowing waters of streams or rivers with major deciduous species being *Alnus rhombifolia, Populus balsamifera, P. fremontii, Salix laevigata,* or *Fraxinus latifolia* = I.B.2.N.d. Temporarily flooded cold deciduous forest**

100B.2A *Alnus rhombifolia* dominant or important tree **= I.B.2.N.d.31 *ALNUS RHOMBIFOLIA* TEMPORARILY FLOODED FOREST ALLIANCE**

100B.2Aa *Alnus* occurs along large westside streams and river terraces often mixed with tree species other than *Calocedrus decurrens*. These include broadleaf deciduous or

evergreen species such as *Salix lasiolepis, S. laevigata, Acer macrophyllum, Quercus chrysolepis,* and *Umbellularia californica* as well as conifers such as *Pinus ponderosa*. May include short trees such as *Cornus nuttallii* in understory and in permanently flooded areas (stream channels) may include the herb *Darmeria peltatum* **= White Alder Forest [*Alnus rhombifolia* Forest] [Potter 1000] (n=8)**

100B.2Ab *Populus balsamifera* ssp. *trichocarpa* (black cottonwood) conspicuous and often dominant. Typically riparian stands adjacent to standing or flowing water = **I.B.2.N.d.36 *POPULUS BALSAMIFERA* SSP. *TRICHOCARPA* TEMPORARILY FLOODED FOREST ALLIANCE**

100B.2Ab.1 *P. balsamifera* occurs in riparian stands on west side of Sierra Crest typically mixed with *Rhododendron occidentalis* (western azalea) and willows such as *Salix lasiolepis* = **Black Cottonwood/(Western Azalea) Forest [*Populus balsamifera* ssp. *trichocarpa*/(*Rhododendron occidentale*) Forest] (n=3)**

100B.2Ab.2 *P. balsamifera* typically occurs along lakes and streams on east side of Sierra Crest mixed with *Pinus jeffreyi* (Jeffrey pine). Understory may include *Cornus sericea* and *Rosa woodsii*. *Abies concolor* may be present in canopy or understory = **Black Cottonwood-Jeffrey Pine Forest [*Populus balsamifera* ssp. *trichocarpa-Pinus jeffreyi* Forest] (n=3)**

100B.2Ac *Populus fremontii* (Fremont cottonwood) major canopy tree, stands uncommon in study area, noted only on east side in Mono Basin along permanent streams below 2,100 meters elevation. No plots and no association defined, but stand with willows noted on photointerpretation reconnaissance trip = **I.B.2.N.d.38 *POPULUS FREMONTII* TEMPORARILY FLOODED FOREST ALLIANCE**

100B.2Ad *Fraxinus latifolia* (Oregon ash) major tree or shrubby tree. Typically scattered small stands along Merced River on low elevation west side of study area. Stands usually in or immediately adjacent to active river channel, may include *Cephalanthus occidentalis* (buttonwillow) **= I.B.2.N.e.28 *FRAXINUS LATIFOLIA* SEASONALLY FLOODED FOREST ALLIANCE** (defined by Potter 1,000-$m^2$ plots) (n=2) No associations defined due to insufficient samples.

100B.2Ae *Salix laevigata* (red willow) the dominant tree **= II.B.2.N.b.14 *SALIX LAEVIGATA* TEMPORARILY FLOODED WOODLAND ALLIANCE**

No associations defined, typically small stands of low gradient rivers and streams in Zones I and II as in Yosemite Valley (n=2)

**100C Mixed evergreen deciduous forest. Evergreen and deciduous species generally contribute 25–75 percent of total tree cover.**

**100C.1 Stands are relatively even mixes of coniferous evergreen and cold deciduous trees.**

100 C.1A. Forests codominated by *Populus tremuloides* (quaking aspen) and the conifer, *Pinus contorta* var. *murrayana* (Sierra lodgepole pine)

100C.1Aa Either *Populus tremuloides* (quaking aspen) or *Pinus contorta* var. *murrayana* (Sierra lodgepole pine) dominant in stands, usually moderately mesic understory including *Poa pratensis* and scattered *Artemisia tridentata*. Eastside meadows and low gradient creek banks **= Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest [*Populus tremuloides-Pinus contorta/Artemisia tridentata/Poa pratensis* Forest] (n=4)**

**100C.1Ab** *Pinus jeffreyi* **a significant component in tree and/or sapling layer. Usually along narrow streams with moderate to steep gradients or upland settings adjacent to meadows on east side of Sierra Crest = Quaking Aspen-Jeffrey Pine Forest [***Populus tremuloides -Pinus jeffreyi* **Forest] new (n=6)**

100C.1B *Calocedrus* and *Alnus* are principal trees in stand, may also include scattered *Abies concolor* and *Pseudotsuga menziesii*. Understory may include *Cornus nuttallii* and *Rhododendron occidentalis*. Stands occupy bottoms and terraces adjacent to streams or other wetlands = **Incense Cedar–White Alder Forest [*Calocedrus decurrens-Alnus rhombifolia* Forest] (Potter 2000 ms) (n=6)**

100C.1C *Calocedrus decurrens* (incense cedar) and *Quercus kelloggii* (California black oak) conspicuous in either sapling/seedling or tree layer. May also include *Pseudotsuga menziesii* (Douglas-fir) in low cover. Widespread on west side of Sierra Crest in ecological Zone II; may be on all slope exposures depending on elevation = **California Black Oak-Incense Cedar Forest [*Quercus kelloggii-Calocedrus decurrens* Forest] (n=9)**

100C.1D *Pinus ponderosa* and *Quercus kelloggii* (California black oak) are both conspicuous in overstory, may have *Calocedrus*.

100C.1Da *Pinus ponderosa* and *Calocedrus decurrens* are dominant and average about 60 percent crown cover. *Quercus kelloggii* present, generally in low to moderate cover, throughout stand, may include some *Pinus lambertiana* (sugar pine) at upper elevation extents of type. *Chamaebatia foliolosa* usually absent or inconspicuous **= Ponderosa Pine-Incense Cedar-California Black Oak Forest [*Pinus ponderosa-Calocedrus decurrens-Quercus kelloggii* Forest] (n=32)** (see also 100A.2Ba.9b.1)

100C.1Db *Pinus ponderosa* and *Calocedrus decurrens* are dominant. Stands are generally more open than above with scattered *Chamaebatia foliolosa*, may have conspicuous scattered shrubs of *Arctostaphylos patula* or scattered low herbs of *Galium bolanderi*; may have significant *Pinus lambertiana* in canopy along with other two conifers, generally at coolest (high elevation) extreme of this alliance = **Ponderosa Pine-Incense Cedar/Mountain Misery Forest [*Pinus ponderosa-Calocedrus decurrens/Chamaebatia foliolosa* Forest] (n=6)** (see also 100A.2Ba.9b.2)

100C.1Dc. *Calocedrus* usually absent. *Pinus ponderosa* and *Quercus kelloggii* forming an open to intermittent canopy over open to relatively dense *Arctostaphylos viscida* (whiteleaf manzanita) along with other shrubs of the chaparral belt. May have *Quercus wislizeni*, *Pinus lambertiana*, *Pinus attenuata*, and *Pinus sabiniana* in small amounts in canopy and *Chamaebatia foliolosa* (mountain misery) and annual *Bromus* sp. in understory **= Ponderosa Pine/California Black Oak/Whiteleaf Manzanita Forest [*Pinus ponderosa/Quercus kelloggii/Arctostaphylos viscida* Forest] (n=5)** (see also 100A2Ba.8)

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## DIVISION 200: VEGETATION CHARACTERIZED BY SHRUBS AND SUBSHRUBS

**200A Shrubs the dominant canopy species, may have denser herbaceous understory, but shrubs typically at least 10 percent cover in most stands. Shrubs usually 0.5 to five meters tall with individuals or clumps not touching to interlocking (generally forming > 25% canopy cover, but see 200A.1A). For scrubs averaging under 0.5 meter in canopy height see dwarf-shrubland section (200B).**

**200A.1 Evergreen shrubland. Evergreen species generally contribute greater than 75 percent of the total shrub and/or tree cover.**

200A.1A Leaves not hardened by a waxy cuticle (sclerophyllous), soft and pliant. Locally represented by a single alliance characterized by the palmately leaved, short-lived *Lupinus albifrons* in Zones I and II. Cover may be sparse (< 25% cover of shrubs) over herbaceous or sparsely herbaceous (or rocky) understory. Another short-lived perennial broad-leafed shrub, *Eriodictyon californica* (Yerba santa) may codominate the shrub layer in some stands. III.A.2.N.a. Temperate broad-leaved evergreen shrubland

Generally seral in recently burned or otherwise disturbed rocky areas in Zones I and II on southerly exposures = **III.A.2.N.a.?? *LUPINUS ALBIFRONS* SHRUBLAND ALLIANCE.** Only one undifferentiated type identified **= *Lupinus albifrons* Herbaceous Vegetation (n=3)**

Note: Some very rocky and steep stands with scattered *L. albifrons* in the canopy have mats of *Selaginella hansenii* in the understory; such stands have not been adequately sampled to define associations.

200A.1B Leaves hardened by a waxy cuticle; sclerophyllous-leaved shrubs the principal canopy species. This includes all chaparral and evergreen montane chaparral scrubs and, by tradition, the needle-leaved *Adenostoma fasciculatum*) = III.A.2.N.c Sclerophyllous temperate broad-leaved evergreen shrubland.

200A.1Ba Chaparral with *Adenostoma fasciculatum* dominant or important.

200A.1Ba.1 Chaparral dominated by *Adenostoma fasciculatum* (chamise) with no other species equaling or exceeding it in cover = **III.A.2.N.c.2 *ADENOSTOMA FASCICULATUM* SHRUBLAND ALLIANCE**

200A.1Ba.1a Chamise and whiteleaf manzanita (*Arctostaphylos viscida*) co-occur, but the manzanita is always less than 30 percent relative cover **= Chamise-Whiteleaf Manzanita Shrubland [*Adenostoma fasciculatum-Arctostaphylos viscida* Shrubland] (n=2**)

200A.1Ba.1b Chamise either sole dominant or other shrub species such as *Ceanothus cuneatus* (Buckbrush) may co-occur, but these at low cover below 30 percent relative cover = **Chamise Shrubland [*Adenostoma fasciculatum* Shrubland] (n=5)**

200A.1Ba.2 Chaparral with both *Adenostoma* important and *Ceanothus cuneatus* important (each > 30% relative cover)= **A.2.N.c ?? *ADENOSTOMA FASCICULATUM-CEANOTHUS CUNEATUS* ALLIANCE** (Gordon & White, 1994). Only one association in the mapping area = **Chamise-Buckbrush Shrubland [*Adenostoma fasciculatum-Ceanothus cuneatus* Shrubland] (n=5)**

200A.1Bb Chaparral with an *Arctostaphylos* species (manzanita) dominant

200A.1Bb.1 Scrub dominated by *Arctostaphylos patula* (greenleaf manzanita) **= III.A.2.N.c.35 *ARCTOSTAPHYLOS PATULA* SHRUBLAND ALLIANCE**

Only one association in mapping area but see also *Quercus vaccinifolia* Alliance. Most stands are seral to tree-dominated vegetation and have variable composition of subordinate shrubs and young trees = **Greenleaf manzanita Shrubland [*Arctostaphylos patula* Shrubland] (n=17)**

200A.1Bb.2 Chaparral dominated by *Arctostaphylos viscida* (whiteleaf manzanita) with variable mixtures of associated shrubs all covering less than 30 percent of the total shrub cover **= III.A.2.N.c.37 *ARCTOSTAPHYLOS VISCIDA* SHRUBLAND ALLIANCE**

As with the *A. patula* alliance, there is a variety of expressions locally including stands that are pure or mostly pure *A. viscida*, stands that have some openings where mountain misery (*Chamaebatia foliolosa*) may occur in the understory, or stands with a small percentage of other shrubs such as buckbrush (*Ceanothus cuneatus*), or bush poppy (*Dendromecon rigida*) or even co-dominance by chamise (*Adenostoma fasciculatum*). These variants are likely a result of fire and other natural and anthropogenic processes and are characterized by wide ranging species that do not serve well as indicators of associations.

These variants have all been subsumed into a single association at this time.

200A.1Bb.2a Stands with *A. viscida* as principal species = **Whiteleaf manzanita Shrubland [*Arctostaphylos viscida* Shrubland] (n=9)**

200A.1Bc Scrubs with evergreen sclerophyllous *Ceanothus* species dominant or important.

200A.1Bc.1 Scrub with *Ceanothus cordulatus* (whitethorn ceanothus or snowbush) as the dominant. Generally occurs in disturbed openings in coniferous forest within ecological Zone III = **III.A.2.N.c.10 *CEANOTHUS CORDULATUS* SHRUBLAND ALLIANCE**

Only one association present. May include other species of shrubs in relative cover less than 40 percent **= Whitethorn Ceanothus Shrubland [*Ceanothus cordulatus* Shrubland] (n=13)**

200A.1Bc.2 Scrub with *Ceanothus cuneatus* (buckbrush) dominant generally occurs in ecological Zones I and II = **III.A.2.N.c.12 *CEANOTHUS CUNEATUS* SHRUBLAND ALLIANCE**

Only one association identified. Other shrub species may be present in relatively low cover, including *Arctostaphylos viscida*, *Toxicodendron diversilobum* and *Keckiella breviflora*. *Bromus* spp. Typically with high relative cover as a group include *B. madritensis*, *B. hordeaceus*, *B. arenarius*, *B. diandrus* and *B. tectorum* = **Buckbrush/Brome Species Shrubland [*Ceanothus cuneatus*/*Bromus* spp. Shrubland] (n=5)**

200A.1Bc.3 Scrub with (chaparral whitethorn) dominant or conspicuous. Locally distributed on southerly facing slopes in Zone I in Merced River Canyon. Often mixed with shrubby *Quercus wislizeni*, *Aesculus californica*, and *Toxicodendron diversilobum* **= III.A.2.N.c.14 *CEANOTHUS LEUCODERMIS* SHRUBLAND ALLIANCE**

Only one association known from the mapping area. Characterized by dominance of *Ceanothus leucodermis* in a mix with *Toxicodendron diversilobum* = **Chaparral Whitethorn/Poison Oak Shrubland [*Ceanothus leucodermis*/*Toxicodendron diversilobum* Shrubland] (n=2)**

200A.1Bc.4 Scrub with *Ceanothus velutinus* (snowbrush ceanothus) dominant or codominant. Usually on east side of Sierra Crest surrounded by *Artemisia tridentata* or other eastside alliances = **III.A.2.N.c.34 *CEANOTHUS VELUTINUS* SHRUBLAND ALLIANCE**

200A.1Bc.4a *Ceanothus velutinus* dominant overstory shrub with a mixture of other eastside shrubs and herbs including *Artemisia tridentata* and *Wyethia mollis*, none acting as strong indicators = **Snowbrush Ceanothus Shrubland [*Ceanothus velutinus* Shrubland] (n=4)**

200A.1Bc.4b *Ceanothus velutinus* dominant, mixed with *Prunus emarginata* (bitter cherry) usually in concavities above 8,000 feet where snow accumulates in winter = **Snowbrush Ceanothus-Bitter Cherry-Big Sagebrush Shrubland [*Ceanothus velutinus*-*Prunus emarginata*-*Artemisia tridentata* Shrubland] (n=3)**

200A.1Bd *Chrysolepis sempervirens* (bush chinquapin) dominant = **III.A.2.N.c.9 *CHRYSOLEPIS SEMPERVIRENS* SHRUBLAND ALLIANCE (aka *Castanopsis sempervirens* alliance)**

Only one association known from the mapping area. Characterized by strong dominance (> 60% relative cover) of *Chrysolepis sempervirens* = ***Chrysolepis sempervirens* Shrubland [Bush chinquapin Shrubland] (n=7)**

200A.1Be Scrub with oaks (*Quercus* spp.) dominant.

200A.1Be.1 Low elevation westside chaparral dominated by scrubby *Quercus wislizeni* (interior live oak). Mixes with typical mesophytic chaparral associates such as *Aesculus californica* and *Toxicodendron diversilobum* = **III.A.2.N.c.33 *QUERCUS WISLIZENI* SHRUBLAND ALLIANCE**

Insufficient information from the two plots sampled to distinguish associations (n=2). Several such stands exist in Zone 1 in recently burned areas (e.g., in the El Portal area). The influence of fire history on the structure and composition of these stands remains to be seen. Tree and scrub versions of *Q. wislizeni* stands may best be placed in the same alliance ultimately.

200A.1Be.2 Scrub of Zones II to IV with *Quercus vaccinifolia* dominant or important. If not dominant, then shared dominance with *Arctostaphylos patula* = **III.A.2.N.c.31 *QUERCUS VACCINIFOLIA* SHRUBLAND ALLIANCE**

200A.1Be.2a *Q. vaccinifolia* overwhelmingly dominant with no other substantial shrub cover **= Huckleberry Oak Shrubland [*Quercus vaccinifolia* Shrubland] (n=2)**

200A.1Be.2b *Q. vaccinifolia* and *Chrysolepis sempervirens* may each range from 30 to 60 percent relative cover **= Huckleberry Oak-Bush Chinquapin Shrubland [*Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland] (n=4)**

200A.1Be.2c Both *Q. vaccinifolia* and *Arctostaphylos patula* dominant or important in shrub canopy (each 30–60% relative cover) = **Huckleberry Oak-Greenleaf Manzanita Shrubland [*Quercus vaccinifolia-Arctostaphylos patula* Shrubland] (Sawyer & Thornburgh) (n=10)**

200A.1Bf Scrubs with *Cercocarpus* spp. (mountain mahogany species) predominant. Not typically considered scrub (see tree-dominated keys) but included here to reduce ambiguity about short stature stands.

200A.1Bf.1 Canopy dominated by the small tree or large shrub *Cercocarpus ledifolius*. Occurs principally in ecological Zones VII and VIII on the east side of the crest on steep rocky sites, associated with *Artemisia tridentata* (big sage) and other Great Basin species = **II.A.5.N.a.1 *CERCOCARPUS LEDIFOLIUS* WOODLAND ALLIANCE**

Note: Stands vary, although most fall into woodland with less than 60 percent canopy cover, there are two unclassifiable plots characterized by high canopy cover. Only one association defined locally with *Symphoricarpos rotundifolius* (round-leaved snowberry) as the characteristic understory species= **Curl-leaf Mountain Mahogany/Roundleaf Snowberry Shrubland [*Cercocarpus ledifolius/Symphoricarpos rotundifolius* Shrubland] (n=8)**

200A.1Bf.2 A short woodland or tall scrub of the west side of the Sierra Nevada in ecological Zones I and II with *Cercocarpus montanus* var. *glaber* (aka *C. betuloides* var. *betuloides*) as the dominant overstory species; may mix with lesser cover of other chaparral shrubs including *Arctostaphylos viscida* and *Ceanothus cuneatus* = **II.A.5.N.a.2 *CERCOCARPUS MONTANUS* VAR. *GLABER* [*C. betuloides* var. *betuloides*, Hickman, 1993] SHRUBLAND ALLIANCE**

A single association identified in the mapping area = **Birchleaf Mountain Mahogany Sierran Chaparral Shrubland [*Cercocarpus betuloides* var. *betuloides* Sierran Chaparral Shrubland] (n=5)**

200A.1C Microphyllous (leaf surface area generally smaller than 1 $cm^2$) evergreen soft-leaved species of shrubs comprise the largest proportion of shrub canopy. III.A.4.N.a Microphyllous evergreen shrubland

**200A.1Ca An *Artemisia* species comprises all or most of the shrub canopy.**

200A.1Ca.1 *Artemisia cana* is the dominant shrub. Scrubs of moist meadow and riparian edges on east side of Zone VIII. Although this is a winter deciduous species and is more properly keyed in the deciduous shrub key (200B), it is also included here to avoid confusion =**III.A.4.N.a.15 *ARTEMISIA CANA* SHRUBLAND ALLIANCE**

Insufficient plot data to completely describe, but two plots suggest an *Artemisia cana/Iris missouriensis-Juncus balticus* association in meadows subjected to long-term grazing.

200A.1Ca.2 *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) is dominant, usually occurs in subalpine to alpine zone adjacent to moist meadows = **III.A.4.N.a.19 *ARTEMISIA TRIDENTATA* SSP. *VASEYANA* SHRUBLAND ALLIANCE**

200A.1Ca.2a *Artemisia tridentata* ssp. *vaseyana* dominant over sparse to dense understory dominated by shorthair sedge often in a subalpine meadow setting = **Mountain Big Sagebrush/Shorthair Sedge Shrubland [*Artemisia tridentata* ssp. *vaseyana/Carex exserta* Shrubland] (n=3)**

200A.1Ca.2b *Artemisia tridentata* ssp. *vaseyana* as dominant with the perennial herb *Monardella odoratissima* in openings along with other shrubs and herbs that occur in low cover **= Mountain Big Sagebrush/Mountain Monardella Shrubland [*Artemisia tridentata* ssp. *vaseyana/Monardella odoratissima* Shrubland] (n=3)**

200A.1Ca.3 *Artemisia tridentata* (largely ssp. *tridentata*, but taxonomy is somewhat unclear and ssp. *wyomingensis* and ssp. *vaseyana* may be present in some samples) is strongly dominant. *Purshia tridentata*, if present, less than 5 percent relative cover. Note: Sufficient samples exist only for one association; however, several may exist. Most of the scrub with *A. tridentata* locally is best considered in the *Purshia tridentata* alliance (200A.1D) **= III.A.4.N.a.17 *ARTEMISIA TRIDENTATA* SHRUBLAND ALLIANCE**

200A.1Ca.3a *Artemisia tridentata* and *Ericameria nauseosa* present and conspicuous in stand with no other major shrub species (although only one sample locally may be equivalent to widespread type in Great Basin). Need more plots locally **= Big Sagebrush-Rubber Rabbitbrush Shrubland [*Artemisia tridentata-Ericameria nauseosa* Shrubland]** (in national classification for NV, ID, OR, WA)

200A.1Ca.3b. *Artemisia tridentata* dominant over sparse understory including the grass *Achnatherum hymenoides;* insufficient samples currently for association description = **Big Sagebrush/Indian Ricegrass Shrubland [*Artemisia tridentata/Achnatherum hymenoides* Shrubland] (n=2)**

200A.1Cb *Purshia tridentata* (antelope bitterbrush) occurs with or without big sagebrush (*Artemisia tridentata)* in shrub layer. In general *Purshia* is a codominant or dominant, but stands occur where *A. tridentata* is in greater cover than *Purshia*. Data analysis

suggests that all stands with significant (ca. > 5% absolute cover) *Purshia* should be grouped together in one alliance **=III.A.4.N.a.13 *PURSHIA TRIDENTATA* SHRUBLAND ALLIANCE**

200A.1Cb.1 *Purshia tridentata and Artemisia tridentata* co-occur throughout stands with *Tetradymia canescens* (horsebush) present = **Antelope Bitterbrush-Big Sagebrush-Spineless Horsebrush Shrubland [*Purshia tridentata-Artemisia tridentata-Tetradymia canescens* Shrubland] (n=5)**

200A.1Cb.2 *Purshia tridentata* and *Artemisia tridentata* co-occur with Indian ricegrass (*Achnatherum hymenoides*) in the openings in the shrub understory = **Antelope Bitterbrush-Big Sagebrush/Indian Ricegrass Shrubland [*Purshia tridentata-Artemisia tridentata/Achnatherum hymenoide*s Shrubland] (n=3)**

200A.1Cb.3 *Purshia tridentata* dominates with little *A. tridentata* over scattered understory with Nevada needlegrass = **Antelope Bitterbrush-Big Sagebrush/ Nevada Needlegrass-(Dore's Needlegrass) Shrubland [*Purshia tridentata-Artemisia tridentata/Achnatherum nevadense-*(*Achnatherum nelsonii*) Shrubland] (n=3)**

200A.1Cb.4 *Purshia tridentata* co-occurs with *Artemisia tridentata* and with the viney round-leaved snowberry (*Symphoricarpos rotundifolia*). Widespread on upper slopes in Zones VII and VIII = **Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Shrubland [*Purshia tridentata-Artemisia tridentata-Symphoricarpos rotundifolia* Shrubland] (n=3)**

200A.1Cc Shrub canopy dominated by the palmately divided shrub of moist alpine and subalpine conditions *Potentilla fruticosa* (aka shrubby cinquefoil or *Pentaphylloides floribunda*). Stands are usually small and associated with meadows or rivulets in ecological Zones IV, V, and VI. Shrub canopy is variable and may average less than 10 percent, thus this is also keyed in the herbaceous key = **V.A.7.N.g.2 *PENTAPHYLLOIDES FLORIBUNDA* SHRUB HERBACEOUS ALLIANCE**

Only one association defined, but some variation shown including a stand sampled with *Carex exserta* and *Trisetum spicatum* and another with *Rhodiola integrifolia ssp. integrifolia* (*Sedum rosea* ssp. *integrifolium*) and *Selaginella watsonii*. The one association has *Danthonia intermedia* as the characteristic species in the herbaceous layer **= Shrubby Cinquefoil/Timber Oatgrass Herbaceous Vegetation [*Pentaphylloides floribunda/Danthonia intermedia* Herbaceous Vegetation] (n=3)**

**200A.2 Temperate cold deciduous shrubland. Deciduous species generally contribute greater than 75 percent of the total shrub and/or tree cover.**

200A.2A Willows (*Salix* sp.) are not important in the shrub canopy.

200A.2Aa *Artemisia cana* is the dominant shrub. Scrubs of moist meadow and riparian edges on east side of Zone VIII. **= III.A.4.N.a.15 *ARTEMISIA CANA* SHRUBLAND ALLIANCE**

**Insufficient plot data to completely describe, but two plots suggest an *Artemisia cana/Iris missouriensis-Juncus balticus* association in meadows subjected to long-term grazing.**

200A.2Ab The winter deciduous deerbrush (*Ceanothus integerrimus*) is the dominant shrub, usually in recently burned openings in ecological Zone II = **III.B.2.N.a.2 *CEANOTHUS INTEGERRIMUS* SHRUBLAND ALLIANCE**

200A.2Ab.1 *Ceanothus integerrimus* dominates with *Arctostaphylos viscida* as the principal subordinate shrub. In some stands *Arctostaphylos mewukka* (Mewuk manzanita) may be present = **Deerbrush-Whiteleaf Manzanita**

**Shrubland [*Ceanothus integerrimus-Arctostaphylos viscida-(Arctostaphylos mewukka*) Shrubland] (n=2)**

200A.2Ab.2 *Ceanothus integerrimus* dominates with *Ceanothus cordulatus* (whitethorn ceanothus) as the major subordinate species. Insufficient plot data to define association but suggests an upper elevation Zone II/Zone III association following fire in coniferous forest = Deerbrush-Whitethorn Ceanothus Stands [*Ceanothus integerrimus-Ceanothus cordulatus* Stands] (n=2)

200A.2Ac Oceanspray or rock spiraea (*Holodiscus discolor*) dominates. Usually sparse to moderately open shrublands of rocky outcrops in ecological Zones III, IV, VII, and VIII **= III.B.2.N.a.8 *HOLODISCUS DISCOLOR* SHRUBLAND ALLIANCE**

Only one association is well sampled, it occupies open granitic bedrock and slab sites where small stands occur in crevices and other openings among the rocks = **Oceanspray/Sierra Stonecrop-Parsley Fern Shrubland [*Holodiscus discolor/Sedum obtusatum* ssp. *boreale-Cryptogramma achrosthoides* Shrubland] (n=4)**

Other *Holodiscus* stands occur on the east side of the Sierra Crest at high elevations in Zone VII. There are insufficient samples for description (alliance only) (n=2)

200A.2Ad Bitter cherry (*Prunus emarginata*) is the dominant shrub. Stands occur primarily in ecological Zones II, III, and VII **= III.B.2.N.a ?? *PRUNUS EMARGINATA* SHRUBLAND ALLIANCE**

Note: Stands are typically more mesophytic than other "montane chaparral" or scrubs, usually occupying recently disturbed concavities in drier environments or easterly to northerly slopes that accumulate significant snow. Insufficient plot data to define multiple associations. One general association defined **= Bitter cherry Shrubland [*Prunus emarginata* Shrubland] (n=3)**

200A.2Ae The winter deciduous shrub oak *Quercus garryana* var. *semota* [Oregon white oak (Brewer oak)] dominates usually on northerly slopes in the interface between ecological Zones I and II. Insufficient plot for description of association **= III.B.2.N.a.12 *QUERCUS GARRYANA* SHRUBLAND ALLIANCE (n=1)**

200A.2Af Uncertain vegetation type dominated by Eurpoean red elderberry (*Sambucus racemosa*). Generally very local in active talus in Zones V and VI often associated with the sedge *Carex congdonii*. It is treated here because *Sambucus racemosa* ssp. *racemosa* is the visual dominant, although the data suggests that this is an association of the ***CAREX CONGDONII-ARNICA AMPLEXICAULIS* HERBACEOUS ALLIANCE** (Taylor, 1984) (also keys under herbaceous alliances) = **European Red Elderberry/Congdon's Sedge Shrubland [*Sambucus racemosa/Carex congdonii* Shrubland] (Taylor, 1984) (n=1)**

200A.2B Stands with a willow (*Salix*) species as the dominant shrub

200A.2Ba Narrow-leaf willow (*Salix exigua*) the dominant shrub. Occurs along creeks and seeps on east side of study area in Zone VIII. May also occur in Zone I at lowest elevations **= III.B.2.N.d.6 *SALIX EXIGUA* TEMPORARILY FLOODED SHRUBLAND ALLIANCE**

Currently no adequate plot data for association-level description; possibly a *Salix exigua/Juncus* association; occurs on the eastside creeks (n=2)

200A.2Bb Eastwood's willow (*Salix eastwoodiae*) main canopy species, forms a low scrub in high elevation moist to wet meadows and streamsides Zones IV and V; may include both temporarily and seasonally flooded sites = **III.B.2.N.e.20 EASTWOOD'S WILLOW (ALLIANCE) (*SALIX EASTWOODIAE*)**

Currently includes one general association that may be mixed with shrubs such as *Salix orestra* (Sierra willow), subshrubs such as *Vaccinium caespitosum* (bilberry), and herbs such as *Carex scopulorum* var. *bracteosa* (Rock Mountain sedge) = **Eastwood's Willow Shrubland [*Salix eastwoodiae* Shrubland] (n=10) (defined by Potter 1000 ms)**

200A.2Bc As currently defined, an extremely variable alliance defined by dominance of arroyo willow (*Salix lasiolepis*). May occur on lower to midslope west and east sides of study area as well as occasionally up to Zone III or IV **= III.B.2.N.d.36 *SALIX LASIOLEPIS* TEMPORARILY FLOODED SHRUBLAND ALLIANCE**

Currently few plots and only one poorly-defined association. Clearly variable associates from low elevation west side (*Quercus chrysolepis* and *Calycanthus occidentalis*) to high elevation eastside riparian with *Pinus contorta* and *Juniperus occidentalis* = **Arroyo Willow-Canyon Live Oak/Spice Bush Shrubland (*Salix lasiolepis-Quercus chrysolepis/Calycanthus occidentalis* Shrubland) (n=1)**

200A.2Bd Stands dominated by Lemmon's willow (*Salix lemmonii*). Stands usually riparian along rivulets and streams in ecological Zones IV, V, and VII in subalpine and alpine of east and west sides = **III.B.2.N.e?? *SALIX LEMMONII* NEW ALLIANCE (n=3)**

Currently one general association defined for area = **Lemmon's Willow Shrubland [*Salix lemmonii* Shrubland] (n=3) (Potter 1000 ms)**

200A.2Be Dusky willow (*Salix melanopsis*) is the dominant shrub, scattered in area at mid to upper elevations of west side mostly Zones III and IV **= III.B.2.N.e.?? *SALIX MELANOPSIS* SEASONALLY FLOODED SHRUBLAND ALLIANCE**

Currently one association defined by the dominance of *Salix melanopsis* = **Dusky Willow Shrubland [*Salix melanopsis* Shrubland] (n=3) (Potter plots)**

200A.2Bf Stands dominated by the Sierra willow (*Salix orestera*). Upper elevation meadows and streamsides mostly in Zones IV, V, VI, and VII **= III.B.2.N.e ?? *SALIX ORESTERA* SEASONALLY FLOODED SHRUBLAND ALLIANCE (Taylor, 1984).**

The following three associations are defined by Taylor (1984) from the study area and are arranged in order from wet to moist.

200A.2Bf.1 Sierra willow dominant shrub with swamp onion (*Allium validum*) conspicuous in understory =**Sierra Willow/Swamp Onion Shrubland [*Salix orestera/Allium validum* Shrubland] (Taylor, 1984) (n=1)**

200A.2Bf.2 Sierra willow dominant shrub with arrowleaf groundsel conspicuous tall herb = **Sierra Willow/Arrowleaf Groundsel Shrubland [*Salix orestera/Senecio triangularis* Shrubland] (Taylor and Major & Taylor, 1977) (n=3)**

200A.2Bf.3 Sierra willow dominant shrub with shorthair reedgrass (*Calamagrostis breweri*) as the major understory associate = **Sierra Willow/Shorthair Reedgrass Shrubland [*Salix orestera/Calamagrostis breweri* Shrubland] (Taylor, 1984) (n=3)**

200A.2Bg Tea-leaf willow (*Salix planifolia*) dominant low shrub. Generally wet or saturated stream sides, tarn edges, or wet meadows of Zones IV and V **= III.B.2.N.e.23 *SALIX PLANIFOLIA* SEASONALLY FLOODED SHRUBLAND ALLIANCE**

Currently two associations defined in area.

200A.2Bg.1 Tea-leaf willow dominant with mixes of other species including *Salix eastwoodiae, Vaccinium caespitosum, Kalmia polifolia,* and *Polygonum bistortoides* = **Tea-leaf Willow Shrubland [*Salix planifolia* Shrubland] (n=5)**

200A.2Bg.2 Tea-leaf willow occurs along streams in subalpine and alpine meadows with Rocky Mountain sedge (*Carex scopulorum* var. *bracteosa*) = **Tea-leaf Willow-Rocky Mountain Sedge Shrubland [*Salix planifolia/Carex scopulorum* Shrubland] (Taylor, 1984) (n=1)**

**200B Dwarf-shrubland. Low-growing shrubs and/or trees usually under 0.5 meter tall, individuals or clumps not touching to interlocking (generally forming greater than 25% cover). Note: If you encounter unusually low shrubs of typically tall species, you should first try to key these in the shrub key (200A).**

**200B.1 Evergreen dwarf-shrubland. Evergreen species generally contribute greater than 75 percent of the total dwarf-shrub and/or tree cover.**

200B.1A For stands with an *Artemisia* species as the dominant subshrub also see 200A under microphyllous scrubland for occasional tall stands of *A. cana* (a deciduous species) or other *Artemisa tridentata* over 0.5 meter in height.

200B.1Aa *Artemisia arbuscula* (low sagebrush) dominant or important subshrub. Usually on east side of Zone VII or VIII on upper slopes or poor, shallow, and/or rocky soils = **IV.A.1.N.a.13 *ARTEMISIA ARBUSCULA* DWARF-SHRUBLAND ALLIANCE**

200B.1Aa.1 Low sagebrush (*Artemisia arbuscula*) and prickly phlox (*Leptodactylon pungens*) are common subshrubs but may occur with other subshrubs. Usually on shallow rocky soils of mid or upper slopes in Zone VII = **Low Sagebrush/Prickly Phlox Dwarf-Shrubland [*Artemisia arbuscula/Leptodactylon pungens* Dwarf-Shrubland] (n=4)**

200B.1Aa.2 Low sagebrush mixed with low perennial herbs including *Eriogonum microthecum*. Occurs on localized shallow soils of Zone VIII surrounded by *A. tridentata* and *Purshia tridentata* alliance stands. (Was called *Artemisia arbuscula /Poa fendleri* association in intermediate classification) = **Low Sagebrush/Slender Buckwheat Dwarf-Shrubland [*Artemisia arbuscula/Eriogonum microthecum* Dwarf-Shrubland] (n=3)**

200B.1Ab Low scrub dominated by Rothrock sagebrush (*Artemisia rothrockii*). Generally uncommon in the area and probably restricted to metamorphic and volcanic substrates in Zones IV and VII = **IV.A.2.N.a.2 *ARTEMISIA ROTHROCKII* DWARF-SHRUBLAND ALLIANCE** Note: There has been some confusion between this alliance and the *Artemisia tridentata* ssp. *vaseyana* alliance. Thus the identification of the putative association below may be in question. All stands seem to be adjacent to moist meadows in the subalpine zone of the east side.

200B.1Ab.1 *Artemisia rothrockii* occurs in moist or drying meadow edges in Zone VII on metamorphics associated with mountain monardella (*Monardella odoratissima*) = **Timberline Sagebrush/Mountain Monardella Dwarf-Shrubland [*Artemisia rothrockii/Monardella odoratissima* Dwarf-Shrubland] (Taylor, 1984)**

200B.1B Stands of subshrubs without *Artemisia* present or dominant

200B.1Ba Stands dominated by mountain misery (*Chamaebatia foliolosa*). Usually occupies small openings that have clearly been recently disturbed by fire or logging within forest and woodland alliances of ecological Zone II. This type is not formally considered an alliance at this time but is included as a distinct small patch matrix that may be identified by field investigation. = **IV.A.1.N.a.?? *CHAMAEBATIA***

***FOLIOLOSA* DWARF-SHRUBLAND (informally defined due to early seral and small patch size) (n=4)**

One association represented locally = **Mountain Misery-Whiteleaf Manzanita Dwarf-Shrubland [*Chamaebatia foliolosa-Arctostaphylos viscida* Dwarf-Shrubland]**

200B.1Bb An alpine association of the *Calamagrostis purpurascens* alliance (see 300A.1Bb.1) with the subshrub *Chrysothamnus parryi* ssp. *monocephalus* present in stands = **Purple Reedgrass-Parry Rabbitbrush-Granite Gilia Dwarf-Shrubland [*Calamagrostis purpurascens-Chrysothamnus parryi* ssp. *monocephalus-Leptodactylon pungens* Dwarf-Shrubland (Taylor, 1984) (n=1)**

200B.1Bb Stands with the showy flowered composite herb *Hulsea algida* conspicuous. Local stands are usually associated with scattered subshrubs of *Ericameria discoidea* (alpine goldenbush) and with the herb *Phacelia hastata* ssp. *compacta*. Usually rocky scree areas on mid and upper slopes in alpine Zones V and VI = **V.B.2.N.b.?? *HULSEA ALGIDA* HERBACEOUS ALLIANCE (Taylor, 1984) (see also** 300A.2Ad)

One association represented locally = **Alpine Hulsea-Alpine Goldenbush-Alpine Phacelia Herbaceous Vegetation [*Hulsea algida-Ericameria discoidea-Phacelia hastata* ssp. *compacta* Herbaceous Vegetation] (Taylor, 1984) (n=1)**

**200B.2 Deciduous dwarf-shrubland. Deciduous species generally contribute greater than 75 percent of the total dwarf shrub cover (also see *Artemisia cana* under 200A).**

200B.2A *Vaccinium* spp., *Kalmia polifolia* (mountain laurel), or *Spiraea densiflora* dominant or important in the stand.

200B.2Aa An uncertain alliance of the subalpine and alpine zones of moist meadows with the very low growing *Vaccinium caespitosum* (Sierra bilberry) and graminoids as the principal cover **= IV.B.2.N.a.2 *VACCINIUM (CAESPITOSUM, SCOPARIUM)* DWARF-SHRUBLAND ALLIANCE**

A single association has been defined with *V. caespitosum* sharing cover with shorthair sedge (*Carex exserta*) = **Sierra Bilberry/Shorthair Sedge Dwarf-Shrubland [*Vaccinium caespitosum/Carex exserta* Dwarf-Shrubland] (n=4)**

200B.2Ab The slightly taller subshrub *V. uliginosum* (*V. occidentale*) the dominant subshrub. Occurs in wet meadows in Zones III and IV often with Sphagnum sp. or other fen or saturated meadow soil species = **[IV.B.2.N.d.2 *VACCINIUM ULIGINOSUM* SATURATED DWARF-SHRUBLAND ALLIANCE]**

Includes one defined association = **Bog Blueberry Dwarf-Shrubland [*Vaccinium uliginosum* Dwarf-Shrubland] (n=3)**

200B.2Ac Stands of low lying wet meadows within Zones IV and V usually surrounded by larger stands of *Calamagrostis breweri* alliance at slightly less damp conditions. Usually contains substantial cover of the very low creeping subshrub *Kalmia polifolia* (mountain laurel). *Carex nigricans* is diagnostic but may be in relatively low cover **= V.A.5.N.k.57 *CAREX NIGRICANS* SEASONALLY FLOODED HERBACEOUS ALLIANCE** (see also 300A.1Bb.1b.4)

One association defined by Taylor (1984) = **Black Alpine Sedge-Bog Laurel Dwarf-Shrubland [*Carex nigricans-Kalmia polifolia* Dwarf-Shrubland] (Taylor, 1984) < MMU (n=1)**

200B.2Ac *Spiraea splendens* [*S. densiflora*, Hickman 1993] is the predominant shrub or subshrub in the stand. Usually with *Penstemon newberryi* present, moist rocky settings at relatively high elevations **= Sierra Spiraea-Mountain Pride-Shieldplant Dwarf-**

**Shrubland [*Spiraea splendens-Penstemon newberryi-Streptanthus tortuosus* Dwarf-Shrubland] (Taylor, 1984) (n=7)** see also 300A.2Ba.3a

200B.2B A dwarf willow dominant or conspicuous

200B.2Ba *Salix arctica* (arctic willow) conspicuous creeping woody plant mixed with short forbs and graminoids of sloping alpine meadow and flush areas **= IV.B.2.N.b.2 *SALIX ARCTICA* DWARF-SHRUBLAND ALLIANCE**

One association recognized with the following four species: *Salix arctica, Calamagrostis breweri, Vaccinium caespitosum,* and *Antennaria media* conspicuous in each stand = **Arctic Willow-Shorthair Reedgrass-Sierra Bilberry-Pussytoes Dwarf-Shrubland [*Salix arctica-Calamagrostis breweri-Vaccinium caespitosum-Antennaria media* Dwarf-Shrubland] (n=9)**

200B.2Bb Stands characterized by *Salix nivalis* (snow willow). Only several stands known on metamorphic substrates in alpine zone of the crest or the eastern side of the crest. Insufficient plots for definition of local association = **IV.B.2.N.b.4 *SALIX* (*RETICULATA, NIVALIS*) DWARF-SHRUBLAND ALLIANCE (n=1)**

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**DIVISION 300 VEGETATION CHARACTERIZED BY HERBACEOUS SPECIES**
**300A Herbaceous Vegetation. Graminoids and/or forbs (including ferns) generally forming greater than 10 percent cover with woody cover usually less than 10 percent. This division is broken into perennial graminoid, perennial herb/forb, and annual grass/herb/forb groups.**

**300A.1 Vegetation dominated by perennial grasses or grass-like species (including *Carex, Juncus, Typha,* or *Scirpus*). Graminoids, generally contributing to greater than 50 percent of relative cover. Broken into three groups of different average heights.**

300A.1A Medium tall (about 0.75–1.5 meter tall) perennial vegetation with grasses (300A.1Aa) and/or sedges (300A.1Ab) or rushes (*Juncus* spp.) (300A1.Ac) dominant or conspicuous. Note: There are three main groups here based on the predominant families of grasses or graminoids represented.

300A.1Aa. Stands with grasses (*Poaceae*) dominant or conspicuous, may also have *Carex* spp. and broad-leaved herbs in lower numbers. Note: This group has five alliances characterized by different species of grass as the dominant and characteristic species.

300A.1Aa.1 *Elymus glaucus* (blue wildrye) dominant or conspicuous along with other graminoids, particularly the sedges *Carex pellita* [*C.lanuginosa* in Hickman 1993 nomenclature] or *C. feta* or with the nonnative grass *Agrostis gigantea*. Found in moist to drying soil of meadow edges and openings in mesic forests typically within Zones II and III on the west side of the range or in Zone VII adjacent to meadows or riparian stands of trees and shrubs = **V.A.5.N.d. ?? *ELYMUS GLAUCUS* HERBACEOUS ALLIANCE**

300A.1Aa.1a. *Elymus glaucus* and *Carex lanuginosa* present, either may be dominant but both conspicuous. Westside meadows and meadow edges adjacent to forest or woodland stands = ***Elymus glaucus-Carex lanuginosa* Herbaceous Vegetation (n=4)** (see key to *Carex lanuginosa* at entry 300A.1Be)

300A.1Aa.1b *Elymus glaucus* and *Carex feta* both conspicuous; either may be dominant. Moist to drying meadows on west side in Zones III and IV **= *Elymus Glaucus-Carex Feta* Herbaceous Vegetation (n=3)**

300A.1Aa.2 The wetland grass *Glyceria elata* (tall mannagrass) conspicuous tall grass over a variable shorter herbaceous understory. These are usually small (< 0.5 ha) stands that occur in saturated to moist areas adjacent to permanent

rivulets, freshets, and small streams primarily in Zone III (one major association defined) = **V.A.5.N.j. *GLYCERIA STRIATA* [Glyceria elata in Hickman 1993 nomenclature] TEMPORARILY FLOODED HERBACEOUS ALLIANCE ??**

A single association defined: *Glyceria elata* dominates along with the medium tall herb *Senecio triangularis* (arrowleaf butterweed) and a number of other subordinate herbaceous species including *Lotus oblongifolius* (stream deer vetch) **= Tall Mannagrass Herbaceous Vegetation (*Glyceria striata* [*Glyceria elata* in Hickman 1993] Herbaceous Vegetation) (n=6)**

300A.1Aa.3 *Calamagrostis canadensis* (Canadian reedgrass) the dominant overstory herbaceous species. Wetlands adjacent to streams and in wet meadows primarily in Zones III and IV **= V.A.5.N.k.39 *CALAMAGROSTIS CANADENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Note: There appears to be one variable association that includes several herbs in moderate to low frequency (*Scirpus microcarpus*, *Senecio scorzonella*, *Polygonum bistortoides*, and *Senecio triangularis)* = **Canadian Reedgrass Herbaceous Vegetation [*Calamagrostis canadensis* Herbaceous Vegetation] (n=6)**

300A.1Aa.4 The tufted wetland bunchgrass *Deschampsia caespitosa* (tufted hairgrass) dominant or conspicuous in herbaceous canopy. Ranges in moist to wet meadows from Zone III to Zones V and VI = **V.A.5.N.k.47 *DESCHAMPSIA CESPITOSA* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Note: The associations have been redefined from the intermediate classification. Other associations may be present locally, and further analysis may indicate individual alpine, subalpine, and montane associations; however, currently the data suggests only a single variable association with the following two characteristic species.

**Tufted Hairgrass-American Bistort Herbaceous Vegetation [*Deschampsia caespitosa-Polygonum bistortoides-(Senecio scorzonella)* Herbaceous Vegetation] (n=8)** that now includes the former tufted hairgrass-Coville ragwort (*Deschampsia caespitosa-Senecio covillei*) association (Benedict, 1983)], the former tufted hairgrass-Brewer bittercress association (*Deschampsia caespitosa Cardamine breweri)* (Benedict, 1983), the tufted hairgrass-Longstalk clover (*Deschampsia caespitosa-Trifolium longipes*) association (Ratliff, 1982, 1985), and the tufted hairgrass-Northern goldenrod (*Deschampsia caespitosa-Solidago multiradiata*) association (Taylor, 1984).

300A.1Aa.5 The introduced moist meadow grass *Poa pratensis* (Kentucky bluegrass) is the dominant. Usually associated with meadows in Zones II, III, and IV that have had a history of stock use = **V.A.5.N.k.21 *POA PRATENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Currently only one broad association defined = Kentucky bluegrass Herbaceous Vegetation [*Poa pratensis* Herbaceous Vegetation] (n=4) and also includes the intermediate classification unit *Poa pratensis-Achillea millefolium* (n=2)

300A.1Aa.6 The aquatic grass *Torreyochloa erecta* (spiked false mannagrass) forms an emergent layer or may dominate over a short layer of *Isoetes occidentalis* (western quillwort**) = Western Quillwort-Spiked False**

**Mannagrass Herbaceous Vegetation [*Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation] (similar to Taylor 1984) (n=1) of the *Isoetes* Alliance (see also 300A.2Ca)**

300A.1Ab. Medium tall (about 0.75–1.5 meters tall) perennial vegetation with sedges (*Carex* spp.) dominant. Note: This group has seven alliances locally, each defined by a different dominant *Carex* species.

300A.1Ab.1 The medium tall moist to wet meadow sedge *Carex jonesii* is dominant, usually meadow edges in ecological Zones III, IV, and VII adjacent to willow thickets dominated by *Salix lemmonii* or *S. eastwoodiae* and associated with other ecologically similar herbaceous species including *Glyceria elata, Juncus nevadensis, Carex hoodii, Mimulus primuloides, Viola mackloskyi,* and *Arnica mollis*. As yet poorly defined in the study area but Potter (2000 ms) has plot data for several areas of the Sierra **= V.A.5.N.j.?? *CAREX JONESII* TEMPORARILY FLOODED HERBACEOUS ALLIANCE (Potter 2000 ms) [n=1]**

300A.1Ab.2 Small stands dominated by the medium tall *Carex spectabilis* (showy sedge) occur in alpine and subalpine settings around sheltered rocks, snowmelt streams, and below lingering snowbanks **= V.A.5.N.g.8 *CAREX SPECTABILIS* HERBACEOUS ALLIANCE**

Taylor (1984) mentions two associations from just east of the crest, but samples from our data are few.

300A.1Ab.2a *Senecio triangularis* (arrowleaf groundsel) co-occurs with *Carex spectabilis* in relatively productive stringer meadows along streams and seeps wet throughout the growing season = **Showy Sedge-Arrowleaf Ragwort Herbaceous Vegetation [*Carex spectabilis-Senecio triangularis* Herbaceous Vegetation] (Taylor, 1984)**

300A.1Ab.2b *Carex spectabilis* dominates in a drier usually more rocky setting where moisture diminishes rapidly in later growing season often as a result of snowbank melt = **Showy Sedge-Sibbaldia Herbaceous Vegetation [*Carex spectabilis-Sibbaldia procumbens* Herbaceous Vegetation] (Taylor, 1984) (n=3)**

300A.1Ab.3 *Carex utriculata* (Northwest Territory sedge) usually strongly dominates seasonally flooded and saturated edges of ponds, lakes, or slow-moving streams widespread in Zones III, IV, V, VI, and VII = **V.A.5.N.k.42 *CAREX UTRICULATA* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One widespread association characterized by strong dominance of Northwest Territory sedge **= Northwest Territory Sedge Herbaceous Vegetation [*Carex utriculata* Herbaceous Vegetation] (Halpern, 1986; Taylor, 1984) (n=11)**

300A.1Ab.4 Usually small stands associated with low gradient streams and ponds in Zones III, IV, V, and VII, often adjacent to willow thickets or low gradient stream and pond sedge stands such as *Carex utriculata* association **= V.A.5.N.k.43 *CAREX AQUATILIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

No association defined (n=2) some data from Potter plots (in 2000 ms)

300A.1Ab.5 The relatively tall *Carex pellita* [*C. lanuginosa* in Hickman 1993 nomenclature] (woolly sedge) is dominant usually in moist areas adjacent to wet meadow/forest borders, often associated with *Elymus glaucus* (blue wildrye) and perhaps best considered a part of that alliance locally. The National Vegetation

Classification suggests a slightly wetter moisture regime than is present in most Yosemite stands = **V.A.5.N.k.53 *CAREX PELLITA* [*C. LANUGINOSA*] SEASONALLY FLOODED HERBACEOUS ALLIANCE** see *Elymus glaucus* alliance. Many stands appear to be codominated by *Elymus glaucus* (blue wildrye) (n=0, but see 300A.1Aa.1)

300A.1Ab.6 The distinctive blue-green stemmed *Carex nebrascensis* (Nebraska sedge) dominates mostly in seasonally flooded meadows in Zones III, IV, VII, and VIII =**V.A.5.N.k.56 *CAREX NEBRASCENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One association defined = **Nebraska Sedge Herbaceous Vegetation [*Carex nebrascensis* Herbaceous Vegetation] (Beguin & Major, 1975) (n=3)**

300A.1Ab.7 *Carex vesicaria* (inflated sedge) dominant. Stands ecologically similar to the physiogonomically similar ***Carex utriculata* Herbaceous Vegetation** (300A.1Bc). (*C. vesicaria* distinguished by shorter more bristly spiklets than *C. utriculata*), usually in shallow water of lakes and ponds **= V.A.5.N.k.200 *CAREX VESICARIA* SEASONALLY FLOODED ALLIANCE (UNDES.)** a single association defined by the dominant species.

**Bristly (or inflated) sedge Herbaceous Vegetation [*Carex vesicaria* Herbaceous Vegetation] (n=8)**

300A.1Ac. Medium tall (about 0.75–1.5 meter tall) perennial vegetation with rushes (*Juncus* spp.) dominant or conspicuous.

300A.1Ac.1 *Juncus balticus* (baltic rush) and/or *Juncus mexicanus* (mexican corkscrew rush) dominant or conspicuous, usually of the heavily grazed wet and moist meadows of the east side in Zones VII and VIII **= V.A.5.N.k.13 *JUNCUS BALTICUS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One association defined with mixes of both Mexican and Baltic rush = **Baltic Rush-(Mexican rush) Herbaceous Vegetation [*Juncus balticus (Juncus mexicanus*) Herbaceous Vegetation] (n=3)**

300A.1Ac.2 *Juncus nevadensis* (Nevada rush) dominant. Usually of wet meadows in Zone II or III. Data not well developed locally but assumed a type through more wide ranging sampling by Potter (1000) = **V.A.5.N.k. ?? *JUNCUS NEVADENSIS* HERBACEOUS ALLIANCE (Potter 1000 ms).** No associations defined locally.

300A.1Ac.3 *Juncus mexicanus* dominant species, mostly on eastside grazed meadows. As yet poorly defined alliance, may be best to include within *Juncus balticus* **as V.A.5.N.k ?? *JUNCUS MEXICANUS* HERBACEOUS ALLIANCE??** No associations defined (n=3)

300A.1B Short graminoid group. Major species in stands predominately short alpine or subalpine grasses or graminoid species generally less than 0.75 meter tall, usually of meadows or alpine slopes that dry earlier in the growing season than previous group. This group consists of three subgroups divided by whether the dominant is a grass, sedge, or rush.

*300A.1Ba A short alpine or subalpine grass (*Poaceae*) dominant or conspicuous.*

300A.1Ba.1 *Calamagrostis breweri* (shorthair reedgrass) common and conspicuous in stand (may not be dominant). High montane, subalpine, and alpine grasslands of moist to damp meadows and riparian edges =**V.A.5.N.g.1 *CALAMAGROSTIS BREWERI* HERBACEOUS ALLIANCE** (but see also *Carex scopulorum* alliance included below).

300A.1Ba.1a *Calamagrostis breweri* dominates with *Oreostemma alpigenum* (alpine aster, aka *Aster alpigenus*) the principal constant species. *Vaccinium caespitosum*, if present, in low cover **= Shorthair Reedgrass-Alpine Aster Herbaceous Vegetation [*Calamagrostis breweri-Aster alpigenus* Herbaceous Vegetation] (n=5) (includes the former Shorthair Reedgrass-Gentian-Alpine Aster Association (Ratliff, 1982, 1985))**

300A.1Ba.1b *Calamagrostis breweri* codominates with *Vaccinium caespitosum* (Sierra bilberry) usually slightly drier settings than the former association = **Shorthair Reedgrass-Bilberry Herbaceous Vegetation [*Calamagrostis breweri-Vaccinium caespitosa* Herbaceous Vegetation] (Taylor, 1984) (n=13)**

300A.1Ba.1c *Calamagrostis breweri* dominates with *Trisetum spicatum* (spike trisetem grass) averaging 1–7 percent cover = **Shorthair Reedgrass-Spike Trisetum Herbaceous Vegetation [*Calamagrostis breweri-Trisetum spicatum* Herbaceous Vegetation] (n=4)**

300A.1Ba.1d A poorly defined type described from The Harvey Monroe Hall Research Natural Area with near equal cover of *Calamagrostis breweri*, *Juncus drummondii*, and at least in some cases *Ptilagrostis kingii* = **Shorthair Reedgrass-Drummond Rush Herbaceous Vegetation [*Calamagrostis breweri-Juncus drummondii* Herbaceous Vegetation (Taylor, 1984) (n=1)**

300A.1Ba.1e Stands usually relatively narrow fringes associated with low gradient snowmelt streams and small tarn edges in Zones IV, V, and VI. *Carex scopulorum* var. *bracteosa* (Rocky Mountain sedge) is usually dominant but may only be conspicuous and codominant with *Calamagrostis breweri* in some stands **= V.A.5.N.k.59 *CAREX SCOPULORUM* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Currently only one association recognized. *Calamagrostis breweri* (shorthair reedgrass), *Pedicularis groenlandica* (elephant ears), or *Eleocharis pauciflora* (few-flowered spikerush) may be important = **Rocky Mountain Sedge Herbaceous Vegetation [*Carex scopulorum* var. *bracteosa* Herbaceous Vegetation] (n=14)**

300A.1Ba.2 *Danthonia intermedia* (timber oatgrass) conspicuous, may occur with other grasses in lower cover including *Ptilagrostis kingii*, *Deschampsia caespitosa*, and *Calamagrostis breweri*. Stands of moist alpine and subalpine meadows largely in Zones IV and V = **V.A.5.N.h.4 *DANTHONIA INTERMEDIA HERBACEOUS* ALLIANCE** (and also may include **V.A.7.N.g.2 *PENTAPHYLLOIDES FLORIBUNDA* SHRUB HERBACEOUS ALLIANCE**)

Those stands with an evenly distributed shrub overstory of *Pentaphylloides floribunda (Potentilla fruticosa)* are best treated in the **V.A.7.N.g.2 *PENTAPHYLLOIDES FLORIBUNDA* SHRUB HERBACEOUS ALLIANCE (see 200A.1Cc)**

300A.1Ba.2a No sparse to intermittent overstory of *Pentaphylloides floribunda* (shrubby cinquefoil) present. *Danthonia intermedia* co-occurs with *Antennaria rosea* (alpine pussytoes) in moist meadows **= Timber Oatgrass-Alpine Pussytoes Herbaceous Vegetation**

**[*Danthonia intermedia-Antennaria rosea* Herbaceous Vegetation] (n=4)**

300A.1Ba.2b *Ptilagrostis kingii* (Sierra false needlegrass) co-occurs with *Danthona intermedia* in mesic meadows = **Timber Oatgrass-Sierra False Needlegrass Herbaceous Vegetation** (***Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation (n=1)**

300A.1Ba.2c Has a sparse to intermittent overstory of *Pentaphylloides floribunda* (shrubby cinquefoil), of moist meadow and stream edges usually in alpine zones = **Shrubby Cinquefoil/Timber Oatgrass Herbaceous Vegetation [*Pentaphylloides floribunda* [syn. *Potentilla fruticosa]/Danthonia intermedia* Herbaceous Vegetation] (n=3)**

300A.1Ba.3 *Ptilagrostis kingii* (Sierra false needlegrass) is the dominant species of moist to wet meadows in subalpine and alpine zones. In well developed meadow systems such as Tuolumne Meadows, stands usually fall between *Carex exserta* alliance stands (drier), and *Calamagrostis breweri* alliance stands (wetter). *Danthonia intermedia* may be common but not constant. Other constant species include *Oreostemma alpigenum* (alpine aster) and *Polygonum bistortoides* (American bistort) = **V.A.5.N.k.?? *PTILAGROSTIS KINGII* SEASONALLY FLOODED HERBACEOUS ALLIANCE NO ASSOCIATION DEFINED (n=7)**

300A.1Ba.4 *Deschampsia caespitosa* (Tufted hairgrass) is a conspicuous tufted bunchgrass of moist to wet montane to alpine meadows = **V.A.5.N.k.47 *DESCHAMPSIA CESPITOSA* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

300A.1Ba.4a Note: The associations have been redefined from the intermediate classification. Other associations may be present locally, and further analysis may indicate individual alpine, subalpine, and montane associations; however, currently the data suggests only a single variable association with the following two characteristic species.

**Tufted Hairgrass-American Bistort Herbaceous Vegetation [*Deschampsia caespitosa-Polygonum bistortoides*-(*Senecio scorzonella*) Herbaceous Vegetation] (n=8)** that now includes the former Tufted hairgrass-Coville ragwort (*Deschampsia caespitosa-Senecio covillei*) association (Benedict, 1983)], the former Tufted hairgrass-Brewer bittercress association (*Deschampsia caespitosa-Cardamine breweri)* (Benedict, 1983), the Tufted hairgrass-Longstalk clover (*Deschampsia caespitosa-Trifolium longipes*) association (Ratliff, 1982, 1985), and the Tufted hairgrass-Northern goldenrod (*Deschampsia caespitosa-Solidago multiradiata*) association (Taylor, 1984)

300A.1Ba.5 The introduced moist meadow grass *Poa pratensis* (Kentucky bluegrass) is the dominant. Usually associated with meadows in Zones II, III, and IV that have had a history of stock use = **V.A.5.N.k.21 *POA PRATENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Currently only one broad association defined = **Kentucky Bluegrass Herbaceous Vegetation [*Poa pratensis* Herbaceous Vegetation]** (n=4) also includes interim classification unit *Poa pratensis-Achillea millefolium* (n=2)

300A.1Ba.6 Open stands in the xeric alpine zones (V and VI) with scattered small tufts of *Calamagrostis purpurascens* (purple reedgrass) interspersed between subshrubs or matted perennial herbs such as *Chrysothamnus parryi* ssp.

*monocephalus*, *Eriogonum ovalifolium*, and *Leptodactylon pungens* = **V.A.5.N.g.9 *CALAMAGROSTIS PURPURASCENS* HERBACEOUS ALLIANCE**

300A.1Ba.6a The subshrub *Chrysothamnus parryi* ssp. *monocephalus* generally absent from stands = **Purple Reedgrass-Granite Gilia Herbaceous Vegetation [*Calamagrostis purpurascens-Leptodactylon pungens* Herbaceous Vegetation] (Taylor, 1984) (n=3)**

300A.1Ba.6b *Chrysothamnus parryi* ssp. *monocephalus* present in stands = **Purple Reedgrass-Parry Rabbitbrush-Granite Gilia Herbaceous Vegetation [*Calamagrostis purpurascens-Chrysothamnus parryi* ssp. *monocephalus-Leptodactylon pungens* Herbaceous Vegetation] (Taylor, 1984) (n=1)**

300A.1Ba.7 Open stands in the xeric alpine zones (V and VI) with scattered small tufts of grass in association with subshrubs and low perennial matted herbs

300A.1Ba.7a *Elymus elymoides* (squirreltail), and or *Festuca minutiflora* in association with *Phlox covillei* and other low perennial matted herbs = **V.B.2.N.b?? *PHLOX COVILLEI-ELYMUS ELYMOIDES* HERBACEOUS ALLIANCE (Taylor, 1984)**

300A.1Ba.7a.1 *Festuca minutiflora* and *Penstemon davidsonii* in association with *Phlox covillei* and *Elymus elymoides*. Xeric rocky fell fields = **Coville Phlox-Squirreltail-Small-flowered Fescue-Davidson Penstemon Herbaceous Vegetation [*Phlox covillei-Elymus elymoides-Festuca minutiflora-Penstemon davidsonii* Herbaceous Vegetation]** (was *Festuca minutiflora-Penstemon davidsonii* **(Taylor, 1984)** ) **(n=1)**

300A.1Ba.7a.2 *Phlox covillei* and *Elymus elymoides* in association with the matted umbeliferous *Podistera*, but without *Erigeron pygmaeus*, fewer boulders and large rocks and more uniform xeric (well drained) substrate than former association **= Coville Phlox-Squirreltail-Nevada Podistera Herbaceous Vegetation [*Phlox covillei-Elymus elymoides-Podistera nevadensis* Herbaceous Vegetation] (Taylor, 1984) (n=4)**

300A.1Ba.7a.3 *Podistera nevadensis* and *Elymus elymoides* in association with *Erigeron pygmaeus.* Usually xeric ridgelines and open upper slopes in alpine zone = **Coville Phlox-Squirreltail-Nevada Podistera-Pygmy Daisy Herbaceous Vegetation [*Phlox covillei-Elymus elymoides-Podistera nevadensis-Erigeron pygmaeus* Herbaceous Vegetation] (Taylor, 1984) (n=8)**

300A.1Ba.7b Scattered plants of *Minuartia (Arenaria) nuttallii* in association with *Achnatherum occidentalis* (western needlegrass) and the subshrub *Ericameria discoidea* (alpine goldenbush) = **V.B.2.N.b.?? Nuttall Sandwort-Alpine Goldenbush Alliance (1) (Taylor, 1984) (n=1)**

Note: Field crews identified the *Arenaria* in the single sample as *A. kingii* ssp. *compacta* and not *A. nuttallii.*

300A.1Bb Grasses may be present but sedges (*Carex* sp.), rushes (*Juncus*), or spikerushes (*Eleocharis*) herbaceous forbs or subshrubs are dominant or conspicuous.

There are three main divisions in this group broken down by genera dominants (*Carex* type, *Eleocharis* type, and *Juncus* type).

*300A.1Bb.1 A* Carex *(sedge) dominant or conspicuous. Note: This group includes 12 alliances that are characterized by the dominance or conspicuousness of different species of* Carex.

300A.1Bb.1a Stands characterized by short alpine or subalpine sedges (*Carex* spp.) of uplands or seasonally moist areas; stands are typically open or intermittent cover, not of low-lying productive meadows, streamsides, or lake margins

300A.1Bb.1a.1 Generally found in low-slope snowmelt areas in subalpine and alpine, usually moister and more sheltered than sites with *Carex exserta* alliance = **V.A.5.N.g.4 *CAREX BREWERI* HERBACEOUS ALLIANCE**

Currently only one association = **Brewer Sedge Herbaceous Vegetation [*Carex breweri* Herbaceous Vegetation (Taylor, 1984)] (n=4)**

300A.1Bb.1a.2 *Carex exserta* (shorthair sedge) dominant or conspicuous cespitose sedge often forming large stands in dry to moist meadows, benches, and gently sloping areas in the subalpine and alpine zones throughout; common and conspicuous = **V.A.5.N.g.2 *CAREX* (*FILIFOLIA, EXSERTA*) HERBACEOUS ALLIANCE**

The following associations are arranged from driest to wettest.

300A.1Bb.1a.2a Stands occur in upland settings adjacent to meadows and on benches, in very well drained to moderately well drained sites = **Shorthair Sedge-Pussypaws Herbaceous Vegetation [*Carex exserta-Cistanthe* spp. Herbaceous Vegetation (Burke, 1982)] (n=2)**

300A.1Bb.1a.2b Stands occur in moist meadows and upland borders of wet meadows, dry by the mid growing season = **Shorthair Sedge-Sierra Beardtongue Herbaceous Vegetation [*Carex exserta-Penstemon heterodoxus* Herbaceous Vegetation] (n=10)**

300A.1Bb.1a.2c Stands occur in moist meadows that are usually dry by late growing season **= Shorthair Sedge-Spike Trisetum Herbaceous Vegetation [*Carex exserta-Trisetum spicatum* Herbaceous Vegetation] (n=6)**

300A.1Bb.1a.3 Stands characterized by *Carex congdonii,* a medium-sized sedge of scree and boulder fields of the alpine and subalpine zones. Vegetative cover is usually less than 20 percent. Often associated with scattered shrubs of *Sambucus racemosa* (European red elderberry). In which cases, stands may or may not be dominated by *C. congdonii* = **V.A.5.N.g. ?? CONGDON'S SEDGE-STREAMBANK ARNICA HERBACEOUS ALLIANCE [*CAREX CONGDONII-ARNICA AMPLEXICAULIS***

**HERBACEOUS ALLIANCE](Taylor, 1984)** (see also putative *Sambucus* alliance under shrub alliances) insufficient plot data to define associations in study area.

300A.1Bb.2a.4 *Carex helleri* (Heller's sedge) conspicuous, usually of mid and upper slopes in slightly moist scree or talus appears to have both xeric and mesic associations locally as follows: = **V.A.5.N.g.?? *CAREX HELLERI* HERBACEOUS ALLIANCE (TAYLOR)**

300A.1Bb.1a.4a *Eriogonum incanum* (vagus or silver buckwheat) and *Raillardella argentea* (silver leaf raillardella) may codominate with *C. helleri* merely present or subdominant; fell fields and dry lower slopes in alpine = **Heller Sedge-Silvery Buckwheat-Silky Raillardella Herbaceous Vegetation [*Carex helleri-Eriogonum incanum-Raillardella argentea* Herbaceous Vegetation] renamed Taylor (1984) association**

300A.1Bb.1a.4b *Saxifraga tolmiei* and *Luzula* species are present, often conspicuous. Usually of rocky snowmelt areas in alpine settings = **Heller Sedge-Alpine Saxifrage-Woodrush Herbaceous Vegetation [*Carex helleri-Saxifraga tolmiei-Luzula spicata* Herbaceous Vegetation] (n=1)**

300A.1Bb.2a.4c Stands in rocky alpine settings intermediate in moisture requirements between two previous associations = **Heller Sedge-Parry Rush Herbaceous Vegetation [*Carex helleri-Juncus parryi* Herbaceous Vegetation] (n=1) (Taylor, 1984)**

300A.1Bb.1a.5 Small stands dominated by the medium tall *Carex spectabilis* (showy sedge) occur in alpine and subalpine settings around sheltered rocks, snowmelt streams, and below lingering snowbanks = **V.A.5.N.g.8 CAREX SPECTABILIS HERBACEOUS ALLIANCE**

Taylor (1984) mentions two associations from just east of the crest, but samples from our data are few.

300A.1Bb.1a.5a *Senecio triangularis* (arrowleaf groundsel) co-occurs with *Carex spectabilis* in relatively productive stringer meadows along streams and seeps wet throughout the growing season = **Showy Sedge-Arrowleaf Ragwort -Herbaceous Vegetation [*Carex spectabilis-Senecio triangularis* Herbaceous Vegetation] (Taylor, 1984)**

300A.1Bb.1a.5b *Carex spectabilis* dominates in a drier usually more rocky setting where moisture diminishes rapidly in later growing season, often as a result of snowbank melt = **Showy Sedge-Sibbaldia Herbaceous Vegetation [*Carex spectabilis-***

***Sibbaldia procumbens* Herbaceous Vegetation] (Taylor, 1984) (n=3)**

300A.1Bb.1b Taller sedges dominant; stands usually in low-lying productive meadows, streamsides, or lake margins vegetation cover in stands is typically continuous to intermittent.

300A.1Bb.1b.1 *Carex utriculata* (Northwest Territory sedge) usually strongly dominates seasonally flooded and saturated edges of ponds, lakes, or slow-moving streams widespread in Zones III, IV, V, VI, and VII = **V.A.5.N.k.42 *CAREX UTRICULATA* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One widespread association characterized by strong dominance of Northwest Territory sedge **= Northwest Territory Sedge Herbaceous Vegetation [*Carex utriculata* Herbaceous Vegetation] (Halpern, 1986; Taylor, 1984) (n=11)**

300A.1Bb.1b.2 Usually small stands associated with low gradient streams and ponds in Zones III, IV, V, and VII. Often adjacent to willow thickets or low gradient stream and pond sedge stands such as *Carex utriculata* Herbaceous Vegetation = **V.A.5.N.k.43 *CAREX AQUATILIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

No association firmly defined (n=2) some data from Potter plots (in 1000 ms)

300A.1Bb.1b.3 The distinctive blue-green stemmed *Carex nebrascensis* (Nebraska sedge) dominates mostly in seasonally flooded meadows in Zones III, IV, VII, and VIII **= V.A.5.N.k.56 *CAREX NEBRASCENSIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One association defined **= Nebraska Sedge Herbaceous Vegetation [*Carex nebrascensis* Herbaceous Vegetation] (Beguin & Major, 1975) (n=3)**

300A.1Bb.1b.4 Stands of low-lying wet meadows within Zones IV and V usually surrounded by larger stands of *Calamagrostis breweri* Herbaceous Alliance at slightly less damp conditions. Usually contains substantial cover of the very low creeping subshrub *Kalmia polifolia* (mountain laurel) **= V.A.5.N.k.57 *CAREX NIGRICANS* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

One association defined by Taylor (1984) = **Black Alpine Sedge-Bog Laurel Herbaceous Vegetation [*Carex nigricans-Kalmia polifolia* Herbaceous Vegetation] (Taylor, 1984) < MMU (n=1)**

300A.1Bb.1b.5 Stands usually relatively narrow fringes associated with low gradient snowmelt streams and small tarn edges in Zones IV, V, and VI. *Carex scopulorum* (Rocky Mountain sedge) is usually dominant but may only be conspicuous and codominant with *Calamagrostis breweri* in some stands = **V.A.5.N.k.59 *CAREX SCOPULORUM* SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Currently only one association recognized. *Calamagrostis breweri* (shorthair reedgrass), *Pedicularis groenlandica* (elephant ears), or *Eleocharis pauciflora* (few-flowered spikerush) may be important = **Rocky Mountain Sedge Herbaceous Vegetation [*Carex scopulorum* Herbaceous Vegetation] (n=14)**

300A.1Bb.2 The diminutive spikerush, *Eleocharis pauciflora,* is conspicuous or dominant with no other characteristic species of graminoids (sedges, rushes, or grasses) present. Usually of seasonally flooded muck or organic muds in wet meadows and drying pond and tarn edges **= V.A.5.N.k.62 *ELEOCHARIS QUINQUEFLORA* (syn. *E. pauciflora*) SEASONALLY FLOODED HERBACEOUS ALLIANCE**

Only one association defined for the area = ***Eleocharis pauciflora* Herbaceous Vegetation (Benedict, 1983)**

300A.1Bb.3 A rush (*Juncus* sp.) dominant or conspicuous, may have grasses, sedges, or subshrubs present.

300A.1Bb.3a The short tufted *Juncus parryi* conspicuous, usually of mesic to xeric rock outcrops and slabs or granitic benches with well drained soils of Zones III, IV, V, and VI. May have other species such as *Phyllodoce breweri* (red mountainheather), *Eriogonum incanum* (vagus buckwheat), or *Streptanthus tortuosus* (jewelflower) conspicuous or even dominant **= V.A.5.N.h.14 *JUNCUS PARRYI* HERBACEOUS ALLIANCE**

300A.1Bb.3a.1 *Juncus parryi* common along with *Eriogonum incanum* (vagus or silvery buckwheat) in relatively dry well drained stands in alpine and subalpine **= Parry Rush-Silvery Buckwheat Herbaceous Vegetation [*Juncus parryi-Eriogonum incanum* Herbaceous Vegetation] (Taylor, 1984) (n=7)**

300A.1Bb.3a.2 *Phyllodoce breweri* usually conspicuous in stands = **Parry Rush-Red Mountainheather Herbaceous Vegetation (Juncus parryi-Phyllodoce breweri Herbaceous Vegetation) (Taylor, 1984) (n=1)**

300A.1C Vegetation characterized by tall graminoids usually greater than 1.5 meters in height; two alliances currently identified in mapping area.

300A.1Ca. Uncommon in ditches and marshes of Zones I and II **= V.A.5.N.I.9 *TYPHA* (*ANGUSTIFOLIA, LATIFOLIA*)-(*SCIRPUS* ssp.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (n=3)**

300A.1 Cb Locally occurs in ponds near Tuolumne Meadows in Zone IV = **V.A.5.N.l.16 *SCIRPUS ACUTUS* - (*SCIRPUS TABERNAEMONTANI*) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE** no associations or samples locally

**300A.2 Vegetation dominated by broad-leafed perennial forbs or nongrasslike herbs. This section is divided into three groups: tall perennial forbs, short perennial forbs, and hydromorphic perennial forbs. Most stands are small and confined to micro sites defined by moisture tolerances of the characteristic species.**

300A.2A Vegetation dominated by tall perennial forbs (generally > 0.5 meter tall) of moist to wet settings usually in Zones II, III, IV, and V.

300A.2Aa Vegetation dominated by the coarse broad-leafed liliaceous *Veratrum californicum* (corn lily). Stands may or may not have a significant mixture of the tall

dicot form *Senecio triangularis* (arrowleaf butterweed) = **V.B.2.N.d.8 *VERATRUM CALIFORNICUM* TEMPORARILY FLOODED HERBACEOUS ALLIANCE**

Currently only one association defined with *Senecio triangularis* present and may be codominant **= California False Hellebore-Arrowleaf butterweed Herbaceous Vegetation [*Veratrum californicum-Senecio triangularis* Herbaceous Vegetation] (Taylor, 1984)**

300A.2Ab. The moderately tall leafy *Solidago canadensis* (Canada goldenrod) conspicuous and usually dominant with a mixture of other moist meadow species **= V.B.2.N.a.?? *SOLIDAGO CANADENSIS-ACHILLEA MILLEFOLIUM* ALLIANCE (UNDESCRIBED) (n=4)**

300A.2Ac *Lupinus latifolius* (broadleaf lupine) the dominant species, occurs in moist to wet springs sides, seeps, and meadows, usually partly shaded = **V.B.2.N.d ?? *LUPINUS LATIFOLIUS* HERBACEOUS ALLIANCE (new alliance and single association) (n=4)**

300A.2Ad Vegetation of wet montane to alpine meadows, dominated by *Polygonum bistortoides* (American bistort). (Note: This alliance is provisional in the area, a few stands are dominated by *P. bistortoides*, but upon further sampling and analysis these may be better placed in another alliance such as *Deschampsia caespitosa* alliance.) Common associated species include *Trifolium longipes, Juncus macrophyllus, Penstemon parvifolius* **= V.B.2.N.d.?? *POLYGONUM BISTORTOIDES* UNDESCRIBED HERBACEOUS ALLIANCE (BISTORT UNDESCRIBED HERBACEOUS ALLIANCE (n=4) may include the Longstalk clover (*Trifolium longipes*) association as defined by Ratliff (1982, 1985)**

300A.2Ae *Senecio triangularis* strongly dominant, in montane to alpine wet meadows and streamsides. No plots clearly fall into this alliance, it appears that our data containing significant *S. triangularis* cover is best currently put into the *Veratrum californicum*, *Lupinus latifolius*, or other alliances at this time. However, this is included in key for completeness and breadth of interpretability **= V.B.2.N.d.12 *SENECIO TRIANGULARIS* TEMPORARILY FLOODED HERBACEOUS ALLIANCE**

300A.2 B Vegetation dominated by short perennial forbs (generally greater than 0.50 meter tall). This group includes short, open alpine and subalpine upland types as well as wetland types of freshets and other wet areas. Most stands are small and patchy.

300A.2Ba Open stands in the xeric upland alpine zones (V and VI) with scattered small tufts of grass in association with other perennial herbs.

300A.2Ba.1 *Elymus elymoides* (squirreltail) and/or *Festuca minutiflora* in association with *Phlox covillei* and other low perennial, matted herbs = **V.B.2.N.b?? *PHLOX COVILLEI-ELYMUS ELYMOIDES* ALLIANCE (Taylor, 1984)**

300A.2Ba.1a *Festuca minutiflora* and *Penstemon davidsonii* in association with *Phlox covillei* and *Elymus elymoides*. Xeric rocky fell fields = **Coville Phlox-Squirreltail-Small-flowered Fescue-Davidson Penstemon Herbaceous Vegetation [*Phlox covillei-Elymus elymoides-Festuca minutiflora-Penstemon davidsonii* Herbaceous Vegetation] (was *Festuca minutiflora-Penstemon davidsonii* association [Taylor, 1984]) (n=1)**

300A.2Ba.1b *Phlox covillei* and *Elymus elymoides* in association with the matted umbeliferous *Podistera*, but without *Erigeron pygmaeus*, fewer boulders and large rocks and more uniform xeric (well drained) substrate than former association = **Coville Phlox-Squirreltail-Nevada Podistera Herbaceous Vegetation [*Phlox covillei-Elymus elymoides-Podistera nevadensis* Herbaceous Vegetation] (Taylor, 1984) (n=4)**

300A.2Ba.1c *Podistera nevadensis* and *Elymus elymoides* in association with *Erigeron pygmaeus*. Usually xeric ridgelines and open upper slopes in alpine zone = **Coville Phlox-Squirreltail-Nevada Podistera-Pygmy Daisy Herbaceous Vegetation [*Phlox covillei-Podistera nevadensis-Elymus elymoides-Erigeron pygmaeus* Herbaceous Vegetation] (Taylor, 1984) (n=8)**

300A.2Ba.2 Scattered plants of *Arenaria (Minuartia) nuttallii* often in association with *Achnatherum occidentalis* (western needlegrass) and the subshrub *Ericameria discoidea* (alpine goldenbush) **= V.B.2.N.b.?? Nuttall Sandwort-Alpine Goldenbush (alliance) (1) (Taylor, 1984) (n=1) (Note: Field crews identified the *Arenaria* in this alliance as *A. kingii* ssp. *compacta* and not *A. nuttallii*.)**

300A.2Ba.3 Stands have scattered plants of *Penstemon newberryi* (mountain pride) in association with the annual *Streptanthus tortuosus* (mountain jewelflower) and other small herbs. May also have small shrubs such as *Spiraea densiflora* (mountain spiraea) or scattered emergent *Pinus contorta* var. *murrayana* (Sierra lodgepole pine) in either tree or krummholz form. Widespread on granitic and metamorphic outcrops throughout Zones III to VI **= V.B.2.N.b?? *PENSTEMON NEWBERRYI-STREPTANTHUS TORTUOSUS* HERBACEOUS ALLIANCE (TAYLOR, 1984)** [stands with significant *Pinus contorta* are in *P. contorta* alliance]

300A.2Ba.3a *Spiraea splendens* [*S. densiflora*, Hickman 1993] is the predominant shrub or subshrub in the stand **= Sierra Spiraea-Mountain Pride-Shieldplant Herbaceous Vegetation [*Spiraea splendens-Penstemon newberryi-Streptanthus tortuosus* Herbaceous Vegetation] (Taylor, 1984) (n=7)**

300A.2Ba.3b Stands without shrubs and typically with variable cover of *Selaginella watsonii* **= Mountain Pride-Shieldplant-Watson's Clubmoss Herbaceous Vegetation [*Penstemon newberryi-Streptanthus tortuosus-Selaginella watsonii* Herbaceous Vegetation] (n=5) (Taylor, 1984)**

300A.2Ba.3c Stands with *Sedum obtusatum* ssp. *boreale* (sierra stonecrop) present, may have *Muhlenbergia montana* = **Mountain Pride-Shieldplant-Sierra Stonecrop-Mountain Muhly Herbaceous Vegetation [*Penstemon newberryi-Streptanthus tortuosus-Sedum obtusatum* ssp. *boreale-Muhlenbergia montana* Herbaceous Vegetation] (Taylor, 1984) (n=1)**

300A.2Ba.3d *Pinus contorta* var. *murrayana* conspicuous emergent tree or krummholz shrub over scattered herbaceous understory with mountain pride (*Penstemon newberryi* ssp. *newberryi*); usually rocky outcrops with poor soil development = **Sierra Lodgepole Pine/Mountain Pride Woodland [*Pinus contorta* var. *murrayana*/*Penstemon newberryi* Woodland] (n=5) [of the *Pinus contorta* alliance see 100A.2Ba.1c.4 ]**

300A.2Ba.4 Stands with the showy flowered composite herb *Hulsea algida* conspicuous. Usually rocky scree areas on mid and upper slopes in alpine Zones V and VI = **V.B.2.N.b.?? *HULSEA ALGIDA* HERBACEOUS ALLIANCE (Taylor, 1984)**

Local stands are usually associated with scattered subshrubs of *Ericameria discoidea* (alpine goldenbush) and with the herb *Phacelia hastata* ssp. *compacta* = **Alpine Hulsea-Alpine Goldenbush-Alpine Phacelia Herbaceous Vegetation [*Hulsea algida-Ericameria*

***discoidea-Phacelia hastata* ssp. *compacta* Herbaceous Vegetation] (Taylor, 1984) (n=1)**

300A.2Ba.5 Low density stands of rock jumbles and talus, usually cold sheltered locations in alpine zone. The characteristic species locally are *Oxyria digyna* (mountain sorrel) and *Draba lemmonii* (Lemmon's whitlow grass) **= V.B.2.N.b.?? *OXYRIA DIGYNA* ALLIANCE (TAYLOR, 1984), *Draba lemmonii-Oxyria digyna* association (Taylor, 1984) (n=1)**

300A.2Ba.6 Stands dominated by low scattered herbs including *Rhodiola integrifolia* (*Sedum roseum*) (ledge stonecrop) and *Selaginella watsonii* (Watson's spikemoss). Usually of moist snowmelt areas Taylor (1984) includes these stands in what he calls the NESTED SAXIFRAGE-SUKSDORF MONKEY FLOWER (*SAXIFRAGA NIDIFICA-MIMULUS RUBELLUS*) (ALLIANCE) (4) (TAYLOR, 1984). However, the species *S. nidifica* and *M. rubellus* do not seem to be good indicators throughout the mapping area. Thus we are calling this **Ledge Stonecrop-Watson's Spikemoss Herbaceous Vegetation [*Rhodiola integrifolia-Selaginella watsonii* Herbaceous Vegetation] (Taylor, 1984) (n=1)** within an unknown alliance at this time.

300A.2Bb Moist to wet environments of alpine meadows, streamsides, and similar settings where plant density is relatively high. Most of these vegetation types are currently poorly defined and based on few samples and tentative rules of dominance.

300A.2Bb.1 Stands of moist meadows that are strongly dominated by alpine aster, *Oreostemma alpigenum* var. *andersonii* (syn. *Aster alpigena* var. *andersonii*). These stands are related to the *Carex nigricans* Alliance (see300A.1Bb.1b.4) and perhaps the *Calamagrostis breweri* Alliance (see 300A.1Ba.1a). Currently these stands are strongly dominated by alpine aster with low or no cover of other similar alliance; diagnostic species are tentatively considered **V.B.2.N.d?? *OREOSTEMMA ALPIGENUM* VAR. *ANDERSONII* HERBACEOUS ALLIANCE (ALPINE ASTER HERBACEOUS ALLIANCE??) (n=1)**

300A.2Bb.2 Stands strongly dominated by *Arnica mollis* (hairy arnica). Moist areas adjacent to alpine and subalpine streams and meadows **= V.B.2.N.d?? *ARNICA MOLLIS* HERBACEOUS ALLIANCE (HAIRY ARNICA HERBACEOUS ALLIANCE?? (n=1)** No associations were defined in this project.

300A.2Bb.3 Small stands in wet mossy rises in wet meadows dominated by *Mimulus primuloides* (primrose monkey flower) may be a part of the nationally recognized **V.B.2.N.d.9 *MIMULUS PRIMULOIDES* TEMPORARILY FLOODED HERBACEOUS ALLIANCE.** It is likely that the plot sizes used in this study would be too large to define this alliance.

300A.2Bb.4 Stands strongly dominated by *Penstemon heterodoxus* or *P. rydbergii* (Sierra beardtongue or Meadow penstemon). Too few samples to determine proper alliance for these, related to *Carex exserta* and *Calamagrostis breweri* alliances tentatively placed in **V.B.2.N.b?? *P. RYDBERGII* VAR. *OREOCHARIS* STANDS (MEADOW PENSTEMON STANDS) (UNDESCRIBED) (n=1)**

300A.2C Vegetation dominated by hydromorphic rooted vegetation. Nonemergent graminoids and forbs structurally supported by water and rooted in substrate (e.g., pond weeds and water lilies).

300A.2Ca Predominant species are short, often submerged in shallow water of ponds and lakes for much of the growing season = **V.C.2.N.a.6 *ISOETES* (*BOLANDERI, ECHINOSPORA, OCCIDENTALIS, NUTTALLII*) PERMANENTLY FLOODED HERBACEOUS ALLIANCE**

300A.2Ca.1 The aquatic grass with partially floating blades *Torreyochloea erecta* (spiked false mannagrass) forms an emergent layer or may dominate over a short layer of *Isoetes occidentalis* (western quillwort) **= *Western Quillwort-Spiked False Mannagrass Herbaceous Vegetation* [*Isoetes occidentalis-Torreyochloea erecta* Herbaceous Vegetation]** (similar to *Torreyochloa pallida* var. *pallida-Isoetes bolanderi* of Taylor 1984) **(n=1)**

**300A.2Ca.2 *Isoetes occidentalis* is the sole dominant species in the stands = *Western Quillwort Herbaceous Vegetation* [*Isoetes occidentalis* Herbaceous Vegetation] (n=2)**

300A.2Cb Predominant species are elongated floating or submerged-leaved hydrophytes

300A.2Cb.1 *Nuphar lutea* (yellow pond lily) dominant or conspicuous **= V.C.2.N.a.9 *NUPHAR LUTEA* PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE**, no plots, but likely occurs in the study area.

300A.2Cb.2 Pond weeds (*Potamogeton* sp. are dominant = **V.C.2.N.a.23 *POTAMOGETON* (*DIVERSIFOLIUS, FILIFORMIS*) PERMANENTLY FLOODED HERBACEOUS ALLIANCE,** no plots, but is known from some shallow lakes in the study area.

300A.2Cb.3 *Sparganium angustifolium* (narrow-leaf bur-reed) the dominant species, usually of shallow lakes and ponds, common throughout Zones III, IV, V, VI, and VII = **V.C.2.N.a.20 *SPARGANIUM ANGUSTIFOLIUM* PERMANENTLY FLOODED HERBACEOUS ALLIANCE**

Locally represented by ***Sparganium angustifolium* Herbaceous Vegetation (n=5)**

**300A.3 Vegetation dominated by annual grasses or forbs**

*300A.3A Annual vegetation characterized by native or nonnative annual forbs*

300A.3Aa *Centaurea solstitialis* dominates stands in Zone I usually only conspicuous after the early spring annuals are dead (June–July). The species is an invasive exotic that is being actively managed in the environs but does form a distinctive cluster in the analysis. Currently considered an alliance with limited plot data. Otherwise similar to the following native annual alliance = **V.D.2.N.c? YELLOW STAR THISTLE ALLIANCE?? (n=1)**

300A.3Ab Stands dominated by early spring flowering annuals including *Lotus* and *Trifolium* species. Later in the growing season other annuals such as Lessengia predominate = **V.D.2.N.c? CALIFORNIA ANNUAL HERBLAND ALLIANCE? (n=3)**

**No plots were sampled, but stands were observed with high relative cover of native annual forbs in zone 1. Sampling is needed to determine if there is a local expression of this alliance. Taxa expected include T*rifolium* sp., *Lotus* sp., *Lessingia* sp. and native annual and perennial grasses.**

*300A.3B Annual vegetation dominated by nonnative annual grasses*

300A.3Ba Vegetation dominated by annual nonnative grasses of the genus *Bromus*. Also includes native annual *Trifolium* species = **V.D.2.N.d.1 *BROMUS* (*DIANDRUS, HORDEACEUS, MADRITENSIS*) HERBACEOUS ALLIANCE (California annual grassland Alliance)**

Represented locally by one variable association **Soft Chess-Ripgut Brome-Small-Head Clover-American Wild Carrot Herbaceous Vegetation [*Bromus***

***hordeaceus-Bromus diandrus-(B. madritensis)-Trifolium* microcephalum-*Daucus pusillus* Herbaceous Vegetation] (n=3)**

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# Appendix K: Descriptions of Vegetation Associations within Yosemite Vegetation Mapping and Classification Project Boundaries

This appendix is broken into five subsections. Each subsection treats the vegetation within one or two of the eight ecological zones identified for the study area. Placement of vegetation types into zones is usually straightforward. However, some types clearly span more than one zone. In such cases, we have elected to assign a particular type of vegetation to its modal zone, where it is most characteristically found in greatest frequency. The authors of the descriptions are Sau San, Michael Schindel, Diana Hickson, and Todd Keeler-Wolf. All descriptions were edited by Todd Keeler–Wolf. The principal author of ecological Zones I and II was Sau San; Zones III and IV were authored by Keeler-Wolf, Hickson, and Schindel; Zones V and VI were largely written by Schindel; and Zones VII and VIII were written primarily by Schindel and Keeler–Wolf. Within each section, the descriptions are broken into herbaceous-, shrub-, and tree-dominated vegetation. The location of each may be found in the table of contents.

Included herein are 185 descriptions. Several that were slated to be written earlier in the project have proven to be phases of other associations or had insufficient data to support their descriptions (see Appendix M for list of undescribed types). These descriptions should in most cases be considered preliminary. Yosemite has an extensive array of vegetation types, the relationships among which are becoming understood for the first time. More than 100 new vegetation types were defined as a result of the data collected and analyzed for the production of this report (see types in Appendix I noted as new). Although this project has made great strides in clarifying vegetation relationships in the central Sierra Nevada, many of the nuances are yet to be understood. There are many similar types that will require further sampling. Further analysis of the vegetation plot data from Sequoia and Kings Canyon national parks will provide some clarification of many of these closely related types. The notion of basing association descriptions on as little as three plots is usually relatively untenable. Although field observation of additional stands was usually available, there is a strong need to collect further plot data on many of the vegetation types defined by fewer than 10 plots.

Each description is written in a standardized format used by NatureServe to induct newly defined vegetation types into the National Vegetation Classification System (see below for descriptive template).

### *INFORMATION IN VEGETATION DESCRIPTIONS*

GLOBAL NAME
Association name based on Latin names of dominant or characteristic plant species. The association (or plant association) is the finest level of the classification system. It is the level at which community inventory and conservation action are aimed.

COMMON NAME
Association common name; same as the GLOBAL NAME but with common names instead of scientific names for the species.

SYNONYM

A unique name by which the community may be more easily recognized or described.

PHYSIOGNOMIC CLASS
The second level of the National Vegetation Classification System that is a vegetation structural classification adapted from UNESCO in 1973 and Driscoll et al., 1984. This level is based on the structure of the vegetation. This is determined by the height and relative percentage of cover of the dominant life-forms: tree, shrub, dwarf-shrub, herbaceous, and nonvascular.

PHYSIOGNOMIC SUBCLASS
The third level of the National Vegetation Classification System. This level is determined by the predominant leaf phenology of classes defined by a tree, shrub, or dwarf-shrub stratum; the persistence and growth form of herbaceous and nonvascular vegetation; and particle size of the substrate for sparse vegetation (e.g., consolidated rocks, gravel/cobble).

PHYSIOGNOMIC GROUP
The fourth level of the National Vegetation Classification System. The group generally represents a grouping of vegetation units based on leaf characters such as broadleaf, needleleaf, microphyllous, and xeromorphic. These units are identified and named with broadly defined macroclimatic types to provide a structural–geographic orientation, but the ecological climate terms do not define the groups *per se*.

PHYSIOGNOMIC SUBGROUP
The fifth level of the National Vegetation Classification System represents a distinction between natural vegetation including natural, seminatural and some modified vegetation, and cultural vegetation (planted/cultivated).

FORMATION
The sixth level of the National Vegetation Classification System represents a grouping of community types that share a definite physiognomy or structure and broadly defined environmental factors such as elevation and hydrologic regime.

ALLIANCE: Level of the National Vegetation Classification System reflecting a physiognomically uniform group of plant associations sharing one or more diagnostic species (dominant, differential, indicator, or character) that (generally) are found in the uppermost stratum of the vegetation.

CLASSIFICATION CONFIDENCE LEVEL: The degree of confidence associated with the classification of the Element (association or alliance). This confidence is based on the quality and type of data used in the analysis as well as the extent to which the entire (or potential) range of the Element was considered.

1 STRONG - Classification based on recent field data. Information is based on Element Occurrences or other data based on occurrences that can be relocated. Classification considers information collected across the entire range or potential range of the Element. Classification may be based on quantitative or qualitative data.

2 MODERATE - Classification is based on data that is of questionable quality, limited numbers of sample points, or data from a limited range.

3 WEAK - Classification is based on secondary or anecdotal information or a new type for which data have only been collected at a small number of sites.

USFWS WETLAND SYSTEM:
USFWS Wetland Classification System, if applicable. (Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* United States Fish and Wildlife Service. Washington, DC).

RANGE:
*Globally*
Description of the association's present range including states of occurrence.

*Yosemite National Park*
Description of where the community is found in the Park (if known).

ENVIRONMENTAL DESCRIPTION
*Globally*
Most important environmental determinants of the biological composition or structure of this association and/or its subtypes.

*Yosemite National Park*
Important environmental determinants of the biological composition or structure of this association within the Park (if known).

MOST ABUNDANT SPECIES
*Globally*
Stratum Species
Most abundant species by stratum.

*Yosemite National Park*
Stratum Species
Most abundant species by stratum.

CHARACTERISTIC SPECIES
*Globally*
Stratum Species
Latin names of plant species not necessarily most abundant but that are characteristic or diagnostic of the association when taken singly or in combination with other species.

*Yosemite National Park*
Stratum Species
Characteristic species for the association, if different from global species.

VEGETATION DESCRIPTION
*Globally*
Additional comments on vegetation attributes of the association including species richness, diversity, physiognomic structure, spatial distribution of vegetation, strata height, dominant life-forms, coverage of unvegetated substrate, and additional compositional comments.

*Yosemite National Park*
Vegetation description for the association, if different from global concept.

OTHER NOTEWORTHY SPECIES
High ranked species, animals, endemics, disjuncts, or exotics that are found within occurrences of this association.

CONSERVATION RANK
Global Element Rank that characterizes the relative rarity or endangerment of the association worldwide.

RANK JUSTIFICATION
Reason for assigning the Global Element Rank, such as number of occurrences, number of hectares, total area reduction from original, threats, degradation, and so forth.

DATABASE CODE
Element Code from the National Community Database.

COMMENTS
*Globally*
Any other comments about this association not covered in the fields above such as landscape relationships, inclusion communities, and so forth.

*Yosemite National Park*
Any other comments about this association specific to the Park including notes about possible problems in photointerpretation.

REFERENCES
Sources of information used to define or describe the association.

PLOTS USED TO DESCRIBE ASSOCIATION
Sample plot numbers used to described the association are indicated using the following formats. All 1998 and 1999 field data are listed first, labeled USGS–NPS Veg Data ,and have a format such as "99K22" or "98M100" (for the year, collector's initial, and sequential number). NRI (1989-1993) data are listed second in regular font. Plots from the Wieslander (1935-1937) data set are listed third and are in bold, italic, underlined font, and plots from the Potter data set are always last in a list and are a 4-digit code in regular font such as "2045."

**Appendix K (continued): Table of Contents for Association Descriptions**

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ECOLOGICAL ZONES I AND II: CHAPARRAL, OAK WOODLANDS, LOW ELEVATION CONIFEROUS AND BROAD-LEAVED SCLEROPHYLL FORESTS AND WOODLANDS OF THE WEST SLOPE

HERBACEOUS ASSOCIATIONS OF ZONES I AND II

## CALIFORNIA ANNUAL HERBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **California Annual Herbland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Annual forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar annual forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Tall temperate or subpolar annual forb vegetation |

Associations from this alliance were not defined in this project due to an insufficient number of samples. Further sampling is required. Three unclassified alliance-level samples were collected. Stands occurred below 1450 m and were dominated by *Lotus unifoliolatus* var. *unifoliolatus*, *Brodiaea elegans*, *Trifolium* spp., and *Vulupia myuros*. This alliance was observed in El Portal, Foresta, and Cherry Lake Road.

USGS-NPS Veg Data: 98M21, 98M27, 98M29 (alliance level only)

## *ELYMUS GLAUCUS* HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Blue Wildrye Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Medium tall bunch temperate or subpolar grassland |

The *Elymus glaucus* Herbaceous alliance occurs at low to mid-elevations (1180–2280 m on the west slope) in valleys and on basin floors often in association with wet meadows on both slopes of the range. Soils are very poorly drained to moderately well drained. Disturbance is common and is usually from exotic plant invasion or road and trail maintenance. Associated species may include *Artemisia douglasiana*, *Agrostis gigantea*, and *Poa pratensis*. This alliance is represented by three associations, all newly defined in this project. They are environmentally very similar with a many overlapping factors. The *Elymus glaucus-Carex pellita* Association is slightly wetter than the *Elymus glaucus-Carex feta* Association. In addition to these two associations, one association-level sample was collected for the undescribed *Elymus glaucus* Herbaceous Vegetation association, suggesting further variation.

USGS–NPS Veg Data: 99K114

### *Elymus glaucus - Carex pellita* (*Carex lanuginosa*, Hickman 1993 nomenclature) Herbaceous Vegetation [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Blue Wildrye - Woolly Sedge Herbaceous Vegetation** |
| **SYNONYM** | **None** |

| | |
|---|---|
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Medium tall bunch temperate or subpolar grassland |
| ALLIANCE | *Elymus glaucus* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland, Palustrine (Seasonally flooded) |

RANGE

**Globally**

This association has been described only from Yosemite Information about its global characteristics is not available without additional inventory. It is likely to occur in moist meadow edges elsewhere in the Sierra Nevada.

**Yosemite and environs**

Stands of *Elymus glaucus* - *Carex pellita* herbaceous vegetation were sampled within the El Capitan and Half Dome 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Elymus glaucus* - *Carex pellita* herbaceous vegetation are found at low elevations (3,900–4,000 feet) at the bottoms of flat mountain valleys (most commonly in Yosemite Valley, locally). Soils are poorly drained to very poorly drained, and textures range from sandy loam to peat from granitic parent material. Litter tends to be high, ranging from 40–99 percent cover. Water can have 0–50 percent cover. Litter consists of 40–99 percent cover. Disturbance is common and is usually caused by invasion of exotic species and sometimes by low to medium impact levels from road or trail construction.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Elymus glaucus, Carex pellita, Poa pratensis*

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Elymus glaucus, Carex pellita, Poa pratensis*

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Elymus glaucus* - *Carex pellita* herbaceous vegetation consist of 90–100 percent cover at 0.5–1 meter tall. This association forms a continuous layer dominated by *Elymus glaucus, Carex pellita (= Carex lanuginosa),* and *Poa pratensis.* Often found in this association are *Artemisia douglasiana, Agrostis stolonifera, Carex feta,* and *Equisetum arvense. Cirsium vulgare, Solidago californica, Lotus unifoliolatus, Brodiaea elegans,* and *Juncus balticus* may be found contributing to minor cover. Occasionally, *Asclepias fascicularis, Iris missouriensis, Juncus mexicanus,* and *Rumex acetosella* may be common.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2?

RANK JUSTIFICATION Likely to be a type that is heavily influenced by grazing and invasion of exotics. It is also likely to be a type of very limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
There is high overlap in the environmental settings of *Elymus glaucus-Carex pelita (lanuginosa)* herbaceous association and the following *Elymus glaucus-Carex feta* association including elevation (same base elevation but *E. glaucus-C. feta* ranging higher based on 3 vs. 4 plots), soil textures (sandy loam to peat vs. sand to peat), parent material, litter cover, and source of disturbance. *Elymus glaucus* and *Poa pratensis* are shared between the two types for most abundant species and characteristic species. *C. feta* occurred in two of the four *E. glaucus-C. lanuginosa* plots. At least eight species are shared among the plots in the two types. With further data lumping of these two assiociations may be supportable. We have chosen to keep them separate here because one (*E. glaucus-C. feta*) appears to be somewhat less mesic, regularly occurring in upland settings, while the other is more consistently mesic to vernally saturated. Both associations are considered tentative and should be supplemented with further plot data and analysis.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K34, 98M32, 98K28, 98K29

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***Elymus glaucus - Carex feta* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Blue Wild Rye - Greensheath Sedge Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Medium tall bunch temperate or subpolar grassland |
| ALLIANCE | *Elymus glaucus* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland, Palustrine (Seasonally flooded) |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Elymus glaucus* - *Carex feta* herbaceous vegetation are sampled in the mapping area of Yosemite and environs within the Half Dome, Mt. Dana, and Wawona 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Elymus glaucus* - *Carex feta* herbaceous vegetation are found at low to midelevations (3,900–7,500 feet) on the bottoms of mountain valleys and basin floors. Soils are very poorly drained to moderately well drained with textures ranging from sand to peat and of igneous and granitic parent materials. Litter ranges from 30–99 percent cover but tends to be high. Disturbance tends to be from invasion of exotics, road or trail construction, and development with low to medium impact levels. Some sites may be in seasonally flooded, palustrine areas.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Elymus glaucus, Poa pratensis*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Elymus glaucus, Poa pratensis, Carex feta*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association forms a continuous herbaceous layer dominated by *Elymus glaucus, Carex feta,* and *Poa pratensis.* Often found in this association is *Lotus unifoliolatus* var. *unifoliolatus, Rumex acetosella, Artemisia douglasiana,* and *Potentilla* sp. Occasionally, *Carex athrostachya, Juncus xiphioides, Penstemon rydbergii* var. *oreocharis, Achillea millefolium, Juncus* sp., and *Solidago californica* are common. Other species that may be found contributing to minor cover may include *Agrostis gigantea, Bromus hordeaceus, Bromus japonicus, Bromus tectorum, Carex* sp., *Deschampsia danthonioides, Equisetum laevigatum, Euthamia occidentalis, Lessingia leptoclada, Linanthus ciliatus, Stachys albens, Madia elegans* ssp. *elegans, Muhlenbergia richardsonis,* and *Poa compressa.* Stands of *Elymus glaucus* - *Carex feta* herbaceous vegetation consist of 90 percent cover at 0–0.5 meter tall and 100 percent cover at 0.5–1 meter tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2?

RANK JUSTIFICATION Likely to be a type that is heavily influenced by grazing and invasion of exotics. It is also likely to be a type of very limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**
Similar stands have been observed in the Sierra Nevada as far north as Grass Valley (Keeler–Wolf pers obs 2002).

**Yosemite and environs**
This association appears to be present on both the east and west side of the Sierra Crest, associated with moist meadows in either Zone II or Zone VIII. See also comment on similarity in *E. glaucus-C. pelita* association.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K33, 98K36, 98M48

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***CENTAUREA SOLSTITIALIS* HERBACEOUS ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Yellow Star-thistle Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Annual forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar annual forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Tall temperate or subpolar annual forb vegetation |

This alliance occurs throughout California annual grassland habitat in the Central Valley and adjacent foothills in northern and central California below approximately 1850 m. The alliance has not been described previously. It is dominated by the non-native, invasive annual *Centaurea solstitialis.* Sites are most commonly in full sun on deep, well-drained soils where annual rainfall is between 25 and 150 cm. Density of the dominant species varies with site characteristics and stage of invasion with species diversity decreasing over time. California annual grassland species are typical associates, including *Bromus diandrus*, *B. hordeaceus*, *Trifolium* spp., *Vulpia myuros*, and *Hypochaeris glabra*. Associations from this alliance were not defined in this project due to an insufficient number of samples. Further sampling is required. One unclassified alliance-level sample was collected.

USGS-NPS Veg Data: 98K4 (alliance level only)

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***Bromus hordeaceus* - *Bromus diandrus* - (*B. madritensis*) - *Trifolium microcephalum* – *Daucus pusillus* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Soft Chess - Ripgut Brome - (Compact Brome) - Small-head Clover -American Wild Carrot Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Annual graminoids |
| PHYSIOGNOMIC GROUP | Temperate or subpolar annual grasslands |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Tall temperate or subpolar annual grassland |
| ALLIANCE | Bromus (diandrus, hordeaceus, madritensis) Herbaceous Alliance (California Annual Grassland Alliance) |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |

USFWS WETLAND SYSTEM Upland

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Bromus hordeaceus* - *Bromus diandrus* - (*Bromus madritensis*) - *Trifolium* microcephalum - *Daucus* pusillus herbaceous vegetation were sampled within the El Portal 7.5 minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Bromus hordeaceus* - *Bromus diandrus* - *(Bromus madritensis)* - *Trifolium* microcephalum - *Daucus* pusillus herbaceous vegetation are found at low elevations (1,700–2,000 feet) on the midslope of southeast- to west-facing, somewhat steep to steep (17–29 degrees), concave, undulating, and linear slopes. Soils are somewhat poorly drained to well drained with textures ranging from loam to clay loam from metamorphic, schist, and gneiss parent materials. Litter ranges from 60–96 percent cover. Disturbance from invasion of exotics is common, and impact levels are low to high.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Bromus hordeaceus, Trifolium microcephalum, Galium parisiense, Avena fatua*

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Bromus hordeaceus, Trifolium microcephalum, Daucus pusillus, Galium parisiense, Hypochaeris glabra*

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Bromus hordeaceus* - *Bromus diandrus* - (*Bromus madritensis*) - *Trifolium microcephalum* - *Daucus pusillus* herbaceous vegetation often form a continuous, sometimes open, herbaceous layer dominated by *Bromus hordeaceus, Trifolium microcephalum, Daucus* pusillus, and *Galium parisiense*. *Avena fatua* and *Hypochaeris glabra* are also present. *Centaurea solstitialis* and *Lotus unifoliolatus* var. *unifoliolatus* can be common at many sites. *Lessingia leptoclada, Bromus arenarius, Trifolium ciliolatum, Lupinus bicolor, Lactuca serriola,* and *Thysanocarpus curvipes* are often found in this association. A variety of other species may be found contributing to minor cover and often include *Avena barbata, Bromus diandrus, Calandrinia ciliata, Castilleja densiflora, Croton setigerus, Silene gallica, Stephanomeria virgata, Torilis arvensis,* and *Vulpia myuros.* This association consists of

0–60 percent cover at 0–0.5 meter tall, 5–90 percent cover at 0.5–1 meter tall, 5–20 percent cover at 1–2 meters tall, and 5 percent cover at 2–5 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2?

RANK JUSTIFICATION It is unusual to find native annual-dominated stands in much of *cis*montane California and these stands tend to be small and localized.

DATABASE CODE To be determined

COMMENTS
**Globally**
There is mounting evidence for an herbaceous annual alliance defined by native species such as *Trifolium microcephalum* and other *Trifolium* species that ranges throughout much of *cis*montane California. Many of the species are widespread and could have been the pre-European cover of much of the nonwooded portions of *cis*montane California prior to the establishment and widespread dominance of non-native annual grasses and herbs. Isolated pockets of these native annual stands should be inventoried and sampled to develop a better synoptic idea of the native annual vegetation of California.

**Yosemite and environs**
This is likely to have been close to the modal expression of many upland herbaceous stands in the Sierra Nevada foothills and perhaps elsewhere in *cis*montane California, prior to the general domiance of openings by non-native annual grasses. The sampling of additional stands of this association and alliance will provide a better picture of restoration potential for the huge areas of relatively highly disturbed and invaded annual vegetation of much of the Sierra Nevada foothill region.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99S17, 98K2, 98K5

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***Typha (angustifolia, latifolia) - (Scirpus* spp.) Semipermanently Flooded Herbaceous Alliance [Provisional]**

(Note: This alliance is represented locally by only three variable samples and is thus treated at the alliance level in the description)

| | |
|---|---|
| **COMMON NAME** | **Cattail - Bulrush Grassland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial Grassland |
| PHYSIOGNOMIC GROUP | Temperate of Subpolar Grassland |
| PHYSIOGNOMIC SUB GROUP | Natural/ Semi- Natural |
| FORMATION | Semi permanently flooded temperate or subpolar grassland |
| ALLIANCE | ***Typha (angustifolia, latifolia) - (Scirpus* spp.) Semipermanently Flooded Herbaceous Alliance** |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Wetland, Palustrine, Emergent Wetland |

RANGE
**Globally**

This alliance is widespread throughout California, the Western United States, and much of North America. Similar stands are found throughout California, although association level information affording more detailed comparison with the local Yosemite stands is lacking.

**Yosemite and environs**
Three stands of this alliance are sampled in the Yosemite, El Capitan and Half Dome 7.5 minute topographic quadrangles. Most stands are small, less than 1 acre.

ENVIRONMENTAL DESCRIPTION
**Globally**
This alliance is found most commonly along lake or pond margins, slow-moving ditches, in shallow basins, adjacent to stream or river channels in wet mud, oxbows, and occasionally in river backwaters. Elevations range from near sea level to around 2000 m. Sites where this alliance occurs are typically semi-permanently flooded, inundated with 30 to 100 cm of water throughout the year. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm.. Soils are characterized by accumulations of organic matter over deposits of fine silt and clay or loams, sandy loams, or coarse sand. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes.

**Yosemite and environs**
This association is found on flat, or gently sloping basin wetlands. Soil textures are mucky and poorly to very poorly drained over granitic substrate. Water typically is at the surface throughout the growing season. Water chemistry is fresh. Sites are from 3800 to 4000 ft elevation. Litter and duff cover is high ranging from 55-80 percent. Standing water covered 10-20 percent of the plots.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Typha latifolia, T. dominigensis,* and *T. angustifolia* are common along with *Scirpus californicus* and a variety of other wetland herbaceous species.

**Yosemite and environs**
Herbaceous *Typha latifolia*

CHARACTERISTIC SPECIES
**Globally**
Herbaceous *Typha latifolia, T. angustifolia*

**Yosemite and environs**
Herbaceous *Typha latifolia*

VEGETATION DESCRIPTION
**Globally**
This alliance is found at low to moderate elevations in virtually every state in the United States and probably most Canadian provinces. It contains stands dominated by *Typha angustifolia* and/or *T. latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the central and western US, they include many sedges such as *Carex aquatilis, C. rostrata, C. lanuginosa*, and bulrushes such as *Scirpus americanus, S. acutus, S. tabernaemontanii*, and *S. heterochaetus*. Other graminoids can include *Juncus* spp., *Eleocharis* spp., or *Glyceria* spp. In the central and eastern parts of its range, broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*, may be present. In the west, forbs may include *Mentha arvensis, Polygonum amphibium, Epilobium ciliatum* and many others. Floating aquatics such as *Lemna minor* may predominate in deeper zones

**Yosemite and environs**

Locally all sampled stands of the *Typha (angustifolia, latifolia) - (Scirpus* spp.) Semipermanently Flooded Herbaceous Alliance form an open to intermittent layer of *Typha latifolia* averaging 39 percent cover. All other species are low cover and are only found in a third of the plots. These include such hydrophytic species as: *Equisetum arvense, Juncus effusus* var. *exiguus, Juncus mexicanus, Agastache urticifolia, Carex feta, Epilobium sp., Galium trifidum, Hypericum formosum, Leucanthemum vulgare, Mentha arvensis, and Ranunculus orthorhynchus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5 S4

RANK JUSTIFICATION This association is expected to be widespread in marshes throughout California and the Pacific states

DATABASE CODE

COMMENT

**Globally**

These relatively simple stands of one to three species of *Typha* and *Scirpus californicus* and/or *Scirpus acutus* have been anecdotally reported throughout many marshes in California from the coast to the inner valleys and deserts.

**Yosemite and environs**

*Typha latifolia, angustifolia*, and *dominigensis* are closely related species that often hybridize. Research in Suisun Marsh (Keeler-Wolf *et al. 2000*) suggested that it was not possible to consistently individuate stands with different *Typha* species either taxonomically or environmentally. Thus, though this type is listed as *Typha (angustifolia, latifolia) - (Scirpus spp.) Alliance*, it also includes other species of *Typha* such as *T. domingensis*. The alliance should probably be considered as a *Typha* sp.-*Scirpus californicus* alliance, however to remain consistent with the existing alliance classification (Sawyer & Keeler-Wolf 1995).

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99K36, 99S50, 99S55

SHRUB/SCRUB ASSOCIATIONS OF ECOLOGICAL ZONES I AND II

***Lupinus albifrons* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Silver Lupine Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Lupinus albifrons* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Stands of *Lupinus albifrons* also occur in the central and north coast ranges in the East Bay Hills and in eastern Napa County (Keeler–Wolf pers. obs.) and are likely to occur elsewhere in *cis*montane California, as this species is found in nearly all counties of the state (Calflora database 2001).

**Yosemite and environs**

Stands of *Lupinus albifrons* shrubland are sampled in the mapping area of Yosemite and environs within the El Portal, Kinsley, and Cherry Lake South 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Lupinus albifrons* shrubland are found at extremely xeric sites at low elevations (1,500–4,700 feet) on the upper, mid, and low portions of southeast- to southwest-facing, undulating and linear, moderately steep to steep slopes. This association generally occurs in very hot, stony sites with a large percent of bedrock or large rocks (average 50% bedrock). Soils tend to be poorly developed and very shallow, skeletal, and stony with textures ranging from metamorphic to gneiss parent materials. Drainage is moderately well drained to rapid. Litter cover ranges from
5–40 percent cover. The amount of bare soil is high and ranges from 5–40 percent cover. Impact from disturbance is low to high and often includes invasion from exotic species.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Lupinus albifrons* |
| Herbaceous | *Selaginella hansenii* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Lupinus albifrons* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Lupinus albifrons* shrubland form a canopy of 7–10 percent cover at 1–2-meters tall. The understory herb layer is typically open with 5–20 percent cover at 0–0.5 meter tall and 5–50 percent cover at 0.5–1 meter tall. The *Clarkia unguiculata, Collinsia heterophylla, Gilia capitata, Melica californica*, and *Streptanthus tortuosus* species are constant in all of the samples, but only one, *Streptanthus tortuosus*, accounts for a cover greater than 2 percent. The herb with the highest cover in any of the plots is *Selaginella hansenii* (up to 15%) (2.5), but it only averages about 5 percent cover. Generally *Lupinus albifrons* is the sole shrub, with the exception of occasional light cover of *Arctostaphylos viscida* or *Toxicodendron diversilobumeters*. Average total cover of all species is low (18%). Other sites not sampled were observed to have cover of *Eriodictyon californicum* comparable to *L. albifrons*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Stands are poorly known and may be locally restricted.

DATABASE CODE To be determined

COMMENTS

**Globally**

Anecdotally, this alliance appears to also occur on road cuts and other steep rocky openings throughout its range.

**Yosemite and environs**

This association occurs in both transitional seral states as along road cuts as well as relatively long-persisting outcrop and steep slope settings where soil development is poor. Since the slopes are generally steep, invasive exotics are usually not as important in these stands as in other open shrub- or herb-dominated stands in the lower elevations of the west side of the mapping area.

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99K44, 99S53, 99S54

***Adenostoma fasciculatum* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Chamise Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Adenostoma fasciculatum* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. However, as this is a generic association characterized by the strong dominance of *Adenostoma fasciculatum*, it is likely that this association is widespread in the Sierra Nevada foothills and perhaps elsewhere in California.

**Yosemite and environs**

Stands of the *Adenostoma fasciculatum* shrubland are sampled in the mapping area of Yosemite and environs within the El Portal, Kinsley, and Cherry Lake South 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Adenostoma fasciculatum* shrubland are found at extremely xeric sites at low elevations (1,700–3,600 feet) on the mid portions of southeast- to southwest-facing, undulating and linear, moderately steep to steep slopes. This association generally occurs in hotter, drier sites such as mid to high slopes, ridge tops, and southwestern slopes off spur ridges and granitic intrusions. Soils tend to be moderately well developed and somewhat stony with textures ranging from loamy sand to clay loam from igneous, granitic, metamorphic, and gneiss parent materials. Drainage is moderately well drained to rapid. Litter cover ranges from 5–40 percent cover. The amount of bare soil is high and ranges from 5–40 percent cover. Impact from disturbance is low to high and often includes invasion from exotic species.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Adenostoma fasciculatum* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Adenostoma fasciculatum*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Adenostoma fasciculatum* shrubland form a two-story structure with a continuous (60–70 percent cover at 2–5 meters tall and 5–90 percent cover at 1–2 meters tall) shrub layer dominated by *Adenostoma fasciculatum* that often occurs with *Ceanothus cuneatus*. Pure stands of *Adenostoma fasciculatum* are usually observed in slightly hotter environments. The understory herb layer is typically open with 5–20 percent cover at 0–0.5 meter tall and 5–50 percent cover at 0.5–1 meter tall. Occasionally common in this association are *Eriodictyon californicum* and cryptogamic crust. Other species that may also be found contributing to minor cover vary but may include *Vulpia myuros, Eriophyllum confertiflorum, Aira caryophyllea, Bromus hordeaceus, Daucus pusillus, Erodium cicutarium, Galium parisiense, Hypochaeris glabra, Pentagramma triangularis,* and *Trifolium microcephalum. Eriophyllum congdonii* is a rare species that may be found contributing to minor cover in this association.

OTHER NOTEWORTHY SPECIES
*Eriophyllum congdonii* is a List 1B species found in one of the four plots. This species occurs in Mariposa County and is usually found in chaparral, *cis*montane woodland, and lower montane coniferous forests on stony metamorphic sites at elevations of 1,650–6,200 feet. It is threatened by nonnative species (CNPS 2001).

CONSERVATION RANK G5?

RANK JUSTIFICATION Probably very widespread in California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
On some slopes in the Merced canyon small stands of this association are surrounded by nonnative-dominated grasslands. These islands appear to be the result of patchy burn patterns, suggesting that relatively high fire frequencies may lead to the reduction of this association.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98K6, 99K17, 98K20, 99S2, 99S6

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***Adenostoma fasciculatum - Ceanothus cuneatus* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Chamise –Buckbrush Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |

ALLIANCE *Adenostoma fasciculatum* - *Ceanothus cuneatus* Shrubland Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. However, it is likely that this association is widespread in *cis*montane California. A similar association called *Adenostoma fasciculatum/Ceanothus cuneatus* association has been described from south coastal California (Gordon and White 1994). It is defined by high shared cover of *Adenostoma fasciculatum* and *Ceanothus cuneatus* but contains high constancy species such as *Yucca whipplei, Arctostaphylos glauca,* and *Eriogonum fasciculatum,* which do not occur locally.

**Yosemite and environs**

Stands of *Adenostoma fasciculatum* - *Ceanothus cuneatus* shrubland are sampled in the mapping area of Yosemite and environs within the El Portal and Kinsley 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Adenostoma fasciculatum* - *Ceanothus cuneatus* shrubland are found at xeric sites at low elevations (1,700–4,000 feet) on the midportions of generally linear and undulating, moderately steep to steep (10–16 degrees) slopes. These sites are usually found on upper canyon slopes and hill slopes. Soils tend to be moderately well developed with textures that range from sandy loam to clay loam from metamorphic, igneous, and granitic parent materials. Drainage is well drained to moderately well drained. Litter consists of 40–60 percent cover and bare soil consists of 15–50 percent cover.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Adenostoma fasciculatum, Ceanothus cuneatus*

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Adenostoma fasciculatum, Ceanothus cuneatus*

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Adenostoma fasciculatum - Ceanothus cuneatus* shrubland form a continuous shrub layer that is codominated by *Adenostoma fasciculatum* and *Ceanothus cuneatus.* Other species present in this association are *Arctostaphylos mewukka, Aira caryophyllea, Hypochaeris glabra, Daucus pusillus, Pentagramma triangularis, Vulpia myuros, Galium parisiense,* and *Erodium cicutarium,* all contributing minor cover. Other species that may occasionally be found in the stands include *Bromus arenarius, Trifolium microcephalum, Anaphalis margaritacea, Eriodictyon californicum,* and *Pellaea andromedifolia. Eriophyllum congdonii* is a rare species that may be found at this association. The structure consists of 5 percent cover at 0–0.5 meter tall, 5 percent cover at 0.5–1 meter tall, 70–90 percent cover at 1–2 meters tall, and sometimes 100 percent cover at 2–5 meters tall.

OTHER NOTEWORTHY SPECIES
*Eriophyllum congdonii* is a List 1B species found in two of the six plots. This species occurs in Mariposa County and is usually found in chaparral, *cis*montane woodland, and lower montane coniferous forests on stony metamorphic sites at elevations of 1,650–6,200 feet. It is threatened by nonnative species (CNPS 2001).

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread in the Sierra Nevada and elsewhere in northern California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Locally, this association has a tendency to be found on ridgelines and more gentle slopes compared to the *Adenostoma fasciculatum* association.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98M14, 99K10, 99K14, 99K9
Wieslander: **417**

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***Arctostaphylos viscida* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Whiteleaf Manzanita Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Arctostaphylos viscida* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. However, the species is widespread in *cis*montane California in the Klamath Ranges and in the Sierra Nevada, thus is probably more common than indicated here.

**Yosemite and environs**

Stands of *Arctostaphylos viscida* shrubland are sampled in the mapping area of Yosemite and environs within the Hetch Hetchy Reservoir 15-minute and El Portal, Buckingham Mountain, and Cherry Lake South 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Arctostaphylos viscida* shrubland are found at xeric to dry mesic sites at low to midelevations (2,800–5,200 feet) of slopes with variable aspects but mostly south facing and on moderately steep drier north- and east-facing slopes. Slopes vary but can be moderately steep to fairly steep usually on the upper portions of east- to southeast-facing, somewhat steep slopes. Sites are usually located on ridge tops and tops of spurs off main ridges with soils that tend to be poorly developed to moderately well developed with textures ranging from sand to silt loam. Soils are well drained to rapidly draining. Parent material is either metamorphic or granitic. Litter can contribute 18–92 percent cover. Bare ground consists of 0–40 percent cover.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Arctostaphylos viscida*

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Arctostaphylos viscida*

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Arctostaphylos viscida* shrubland, a successional association, form open to continuous stands dominated by *Arctostaphylos viscida*. Often found in this association are isolated individuals and multiple juvenile *Calocedrus decurrens, Quercus kelloggii,* and *Chamaebatia foliolosa*. Occasionally, isolated or young *Pinus attenuata, Pinus ponderosa, Pinus jeffreyi, Quercus kelloggii,* and *Apocynum androsaemifolium* are present. A variety of other species present in this association may include *Ceanothus tomentosus, Eriodictyon californicum,Adenostoma fasciculatum, Mimulus floribundus, Chlorogalum pomeridianum, Carex multicaulis, Ceanothus parvifolius, Ceanothus cordulatus, Chamaesyce serpyllifolia, Dendromecon rigida, Lupinus breweri,* and *Prunus emarginata.* This association is fairly common following fire, and species composition is highly variable. The structure consists of 5–20 percent cover at 0–0.5 meters tall, 5 percent cover at 0.5–1 meters tall, 5–40 percent cover at 1–2 meters tall, 10–60 percent cover at 2–5 meters tall, and 40 percent cover at 10–15 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5?

RANK JUSTIFICATION Likely to be a widespread association throughout northern California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Because of the seral nature of the stands we have elected to contain the alliance into one association locally. There is some tendency for a subassociation with more early seral characteristics to occur at lower elevations. This phase has *Dendromecon rigida* as a constant member and was originally individuated as a separate association in the interim classification.

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98K21, 98K63**,** 99S27, 98K32, 98M8, 99K21, 99S24, 99S28, 98K18
NRI: 4

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***Ceanothus cuneatus*/*Bromus* spp. Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Buckbrush/Brome Species Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Ceanothus cuneatus* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. However, it is likely that this association is widespread in *cis*montane California. This association has been observed elsewhere north and south in the Sierra Nevada foothills and likely occurs in the inner central coast foothills.

**Yosemite and environs**
Stands of *Ceanothus cuneatus*/*Bromus* spp. shrubland are sampled in the mapping area of Yosemite and environs within the El Portal 7.5 minute and the Hetch Hetchy Reservoir 15 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Ceanothus cuneatus*/*Bromus* spp. shrubland are found at xeric sites at low to low-moderate elevations (2,340–5,320 feet) on the mid to upper portions of generally linear to convex, moderate to somewhat steep (10–30 degrees) slopes. Exposures are southerly ranging from southwest to south to southeast. These sites are usually found on upper canyon slopes and hill slopes. Soils tend to be moderately well developed with textures that range from

loam to silt loam from metamorphic or granitic parent materials. Soils are generally well drained. Leaf litter cover may be relatively high ranging up to 58 percent cover and bare soil may be up to 30 percent cover.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Hypochaeris glabra, Bromus madritensis, Bromus hordeaceus, Bromus arenarius* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Bromus hordeaceus, Bromus arenarius* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Ceanothus cuneatus*/*Bromus* spp. shrubland form an open shrub layer with a mixed herbaceous dicot and grass understory. Other important species include *Bromus madritensis* (15%), *Centaurea melitensis* (15%), *Hypochaeris glabra* (15%), *Bromus hordeaceus* (8.7%), and *Bromus arenarius* (7.75%). Other shrub species that may be present in this association but with low cover are *Arctostaphylos viscida* ssp. *mariposa*, *Rhamnus crocea* ssp. *ilicifolia*, *Toxicodendron diversilobum* and Keckiella breviflora. *Daucus pusillus, Pellaea mucronata, Trifolium microcephalum, Vulpia myuros, Galium parisiense,* and *Eriodictyon californicum* contribute low cover but occur with relatively high frequency. Other species that may occasionally be found in the stands include *Lessingia leptoclada*. *Eriophyllum congdonii* is a rare species that may be found in this association.

OTHER NOTEWORTHY SPECIES
*Eriophyllum congdonii* is a List 1B species found in one of the five plots. This species occurs in Mariposa County and is usually found in chaparral, *cis*montane woodland, and lower montane coniferous forests on stony metamorphic sites at elevations of 1,650–6,200 feet. It is threatened by nonnative species (CNPS 2001). *Centaurea melitensis*, found in one of the five plots, is an invasive alien species native to Europe and is listed by the California Exotic Pest Plant Council as a Wildland Pest Plant (California Pest Plants of Greatest Ecological Concern, CalEPPC 1999)

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread in the Sierra Nevada and elsewhere in northern California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Locally, this association has a tendency to be found on gentler slopes compared to the *Adenostoma fasciculatum* association. Stands assigned to this association are somewhat disparate, occurring adjacent to low-elevation foothill

woodlands and ranging up into glaciated valleys with sparser understory components. Additional sampling is needed to clarify type.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99S11, 99K37
NRI: 44
Wieslander: **411, 425**

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***CEANOTHUS LEUCODERMIS* SHRUBLAND ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Chaparral Whitethorn Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate broad-leaved evergreen shrubland |

In central and southern California, this alliance is found on south facing, sometimes steep, slopes on alluvial- or bedrock-derived soils. Soils tend to be deep (NatureServe 2007). Precipitation follows the strongly seasonal pattern of the Mediterranean climate with long, dry summers and cool, moist winters. Shrub species present may include *Rhus trilobata*, *Arctostaphylos glauca*, *Adenostoma fasciculatum*, *Quercus wislizeni*, *Ceanothus integerrimus*, *Heteromeles arbutifolia*, and *Eriodictyon* spp.

Locally, this alliance occurs on southerly facing slopes below 3,000 ft. in the Merced River canyon. Chaparral Whitethorn Shrubland Alliance is represented in the project area by one association. The two plots sampled were largely *Ceanothus leucodermis* and *Toxicodendron diversilobum* with an understory of non-native *Bromus* spp. and native annual species. This alliance is often mixed with shrubby *Quercus wislizeni* and *Toxicodendron diversilobum.* Further sampling is required.

USGS–NPS Veg Data: 98K7, 99S43 (*Ceanothus leucodermis*/*Toxicodendron diversilobum* Shrubland)

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***Cercocarpus montanus* var. *glaber* (*C. betuloides* var. *betuloides*, Hickman 1993) Sierran Chaparral Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Birchleaf Mountain Mahogany Sierran Chaparral Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold-deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate cold-deciduous shrubland |
| ALLIANCE | *Cercocarpus montanus* var. *glaber* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

This shrubland association is only known from Yosemite. However, a similar if not identical association is being defined for the western foothills of Sequoia and Kings Canyon national parks. It is likely that it occurs throughout the foothills of the Sierra Nevada.

**Yosemite and environs**
This association is relatively uncommon in Yosemite and environs. The stands occur within the Merced River and the Tuolumne River drainages in ecological Zones I and II.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of the association is not available without additional inventory.

**Yosemite and environs**
This association is found in high slope positions on generally well drained loam and sandy loam soils derived from granitics and metamorphics. Elevations range from 2,980–5,100 feet, and aspects are typically northerly at low elevations and westerly to southwesterly at higher elevations. Litter/Duff cover averages 35 percent. Sites are upland and tend to have between 10–40 percent large rock or bedrock cover.

MOST ABUNDANT SPECIES
**Globally**
This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Cercocarpus montanus* var. *glaber* (=*Cercocarpus betuloides* var. *betuloides*) |
| Shrub | *Cercocarpus montanus* var. *glaber* (=*Cercocarpus betuloides* var. *betuloides*) |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Cercocarpus montanus* var. *glaber* (=*Cercocarpus betuloides* var. *betuloides*) |
| Shrub | *Cercocarpus montanus* var. *glaber* (=*Cercocarpus betuloides* var. *betuloides*) |

VEGETATION DESCRIPTION
**Globally**
This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Although considered a woodland in portions of the west, this is a shrub association in the Yosemite region. The average height for the dominant and characteristic species is around 3–5 meters, but the morphology is typically multistemmed and scraggly. The short tree layer between 2–5 meters averages 44 percent cover and is composed of *Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides var. betuloides). Ceanothus cuneatus* provides an average 10 percent cover in the 1–2 meter shrub layer but is only on 50 percent of the plots. *Toxicodendron diversilobum* is in half of the plots but averages only 1 percent cover. In some stands that have not been sampled, *Arctostaphylos viscida* may be an important shrub. The herb layer varies from 2–10 percent cover and averages 4 percent. No species are abundant in the herb layer. The most constant species from 50–75 percent constancy include *Pentagramma triangularis, Claytonia perfoliata, Galium parisiense,* and *Bromus hordeaceus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to occur throughout the foothills of the entire Sierra Nevada.

DATABASE CODE To be determined

COMMENTS:
**Globally**

**Yosemite and environs**
It is likely that there is another mesophytic association of this alliance with such species as *Fraxinus dipetala* from within the mapping area. No plots are available currently.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98M17, 99K53, 98K12, 99K12
Wieslander: **721**

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***CEANOTHUS INTEGERRIMUS* SHRUBLAND ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Deerbrush Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate broad-leaved deciduous shrubland |

The distribution of this alliance includes Northern California Coast, Klamath Mountains, Northern California Coast Ranges, Southern Cascades, Sierra Nevada, Modoc Plateau, Southern California Mountains and Valleys, Central California Coast, N. Baja California, and southern Oregon. Precipitation follows the strongly seasonal pattern of the Mediterranean climate with long, dry summers and cool, moist winters. Typically this alliance is found on ridges and upper slopes between 300 and 2100 m (NatureServe 2007). Other shrub species that may be present include *Prunus emarginata*, *Arctostaphylos manzanita*, *Arctostaphylos patula*, *Ceanothus cordulatus*, *Ceanothus cuneatus*, *Ceanothus velutinus*, *Symphoricarpos mollis*, and *Holodiscus discolor*.

The *Ceanothus integerrimus* Alliance has been sampled locally between 600 and 1700 m. Generally, it is found on ridges and mid to upper slopes within the mapping area. Soils are igneous derived, well-drained loams. Associated shrub species may include *Ceanothus cordulatus*, *Ribes roezlii*, and *Arctostaphylos viscida*. This alliance is locally represented by one newly-defined association from this project and stands of *Ceanothus integerrimus-Ceanothus cordulatus* that require more sampling for verification as putative association. The *Ceanothus integerrimus - Arctostaphylos viscida* - (*Arctostaphylos mewukka*) Shrubland Association is found at submesic to xeric sites at low to mid elevations. *Ceanothus integerrimus-Ceanothus cordulatus* Stands occur at more mesic sites at higher elevations often on sites with recent fire history.

USGS–NPS Veg Data: 99S48 (*Ceanothus integerrimus-Ceanothus cordulatus* Stands)
Wieslander Data: 719 (*Ceanothus integerrimus-Ceanothus cordulatus* Stands)

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***Ceanothus integerrimus - Arctostaphylos viscida - (Arctostaphylos mewukka)* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Deerbrush – Whiteleaf Manzanita - (Indian Manzanita) Shrubland** |
| **SYNONYM** | **None** |

| | |
|---|---|
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate cold deciduous shrubland |
| ALLIANCE | *Ceanothus integerrimus* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. This is another association that may be found to occur more widely with additional sampling in the Sierra Nevada and the Klamath Mountains.

**Yosemite and environs**

Stands of *Ceanothus integerrimus* - *Arctostaphylos viscida* - (*Arctostaphylos mewukka*) shrubland are sampled in the mapping area of Yosemite and environs within the El Portal, Cherry Lake South, and El Capitan 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Ceanothus integerrimus* - *Arctostaphylos viscida* - (*Arctostaphylos mewukka*) shrubland are found at submesic to xeric sites at low to midelevations (2,000–5,200 feet) on the mid to upper portions of south- to north-facing, linear and convex, moderately steep to somewhat steep slopes. Soils are moderately well drained to well drained with textures ranging from loamy sand to sandy loam of igneous, metamorphic, and granitic parent materials. Litter is 40–88 percent cover. Disturbance at this association is common and includes mostly low and sometimes high impact levels from competition from exotics, logging, grazing, and fire.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus integerrimus* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus integerrimus, Arctostaphylos viscida, Arctostaphylos mewukka* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Ceanothus integerrimus* - *Arctostaphylos viscida* - (*Arctostaphylos mewukka*) shrubland form a continuous shrub layer dominated by *Ceanothus integerrimus* and significantly less *Arctostaphylos viscida* and/or *Arctostaphylos mewukka*. Often found contributing to minor cover is *Pinus ponderosa*, *Bromus tectorum*, *Cercocarpus montanus* var. *glaber* (*Cercocarpus betuloides* var. *betuloides*), *Claytonia perfoliata*, *Vulpia microstachys*, *Elymus glaucus*, *Galium aparine*, and *Madia minima*. Occasionally, *Quercus garryana* var. *semota*, *Toxicodendron diversilobum*, and moss may be common. Other species vary and may include *Adenostoma fasciculatum*, *Aesculus californica*, *Bromus arenarius*, *Bromus diandrus*, *Ceanothus cordulatus*, *Fragaria vesca*, *Lepechinia calycina*, *Potentilla glandulosa*, *Pteridium aquilinum*, *Ribes quercetorum*, and *Staphylea bolanderi*. The structure consists of 3–20 percent cover at 0–0.5 meter tall, 5–20 percent cover at 0.5–1 meter tall, 5–50 percent cover at 1–2 meters tall, and 60–90 percent cover at 2–5 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Uncertain, but may prove to be common in the central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
The identification of *Arctostaphylos mewukka* and *Arctostaphylos viscida* are sometimes problematic and either one or the other or both species may occur in a stand. In general *Arctostaphylos mewukka* is more mesophytic than *Arctostaphylos viscida*. This association was observed to occur extensively within the 1989 Stanislaus Complex burn on the Stanislaus National Forest west Yosemite Valley in the vicinity of upper Bull Creek and upper Ned Gulch, along the Cherry Lake Road, and above Foresta within the 1990 A-Rock burn.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99K27, 99S47

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## *QUERCUS GARRYANA* SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Oregon White Oak Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate broad-leaved deciduous shrubland |

*Quercus garryana* var. *semota* is unusual in being a winter-deciduous, rather than evergreen, shrub oak. It often forms miniature “forests” that frequently exclude other shrub species (Pavlik et al. 1991). Sawyer et al. (2009) indicate that *Q. garryana* Shrubland Alliance in shrub form (var. *semota*) is common on the west slope of the Sierra Nevada and the Tehachapi Mountains. It is found on thin soils of volcanic or metamorphic origin at 600 to 1,800 m, commonly at higher elevations than the woodlands of var. *garryana*. Other shrubby species that may be present include *Ceanothus integerrimus*, *Cercocarpus montanus*, *Pinus sabiniana*, and *Ceanothus cuneatus*. The alliance may occur in a mosaic with woodland and chaparral vegetation such as *Quercus chrysolepis* Alliance, *Q. kelloggii* Alliance, Q. wislizeni Alliance, and Pinus ponderosa Woodland Alliance.

Locally, the *Quercus garryana* Shrubland Alliance occurs along the western edge of the mapping area west of Yosemite National Park on steep slopes between 600 and 1250 m. Associated species may include *Ceanothus integerrimus*, *Arctostaphylos mewukka*, *Toxicodendron diversilobum*, *Lepechinia calycina*, and *Aesculus californica*. Associations from this alliance were not defined in this project due to an insufficient number of stands sampled. Further sampling is required.

USGS–NPS Veg Data: 99K7

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### *SALIX LASIOLEPIS* TEMPORARILY FLOODED SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Arroyo Willow Temporarily Flooded Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous shrubland |

The Arroyo Willow Temporarily Flooded Shrubland Alliance distribution includes California Coast and Coast Ranges, Northern California Interior Coast Ranges, Great Valley, Klamath Range foothills, Sierra Nevada Foothills, Southern California Mountains and Valleys, Mojave Desert, Modoc Plateau, Colorado Plateau, Columbia Plateau, and Baja California (NatureServe 2007, Sawyer and Keeler-Wolf 1995). This alliance is typically found in fresh water habitats within temporarily flooded or saturated floodplains and low gradient depositions along rivers and streams between 1200 and 2490 m.

This alliance is represented locally by a newly-defined association: *Salix lasiolepis-Quercus chrysolepis*/*Calycanthus occidentalis* Shrubland. There are clearly variable associates from low elevation west side (*Quercus chrysolepis* and *Calycanthus occidentalis*) to high elevation east side riparian with *Pinus contorta* and *Juniperus occidentalis*. Other associated species may include *Toxicodendron diversilobum*, *Rubus discolor*, and *Aesculus californica*. Further sampling is needed. One association-level sample was collected for an undescribed association, and one unclassified alliance-level sample was taken, suggesting further variation.

NRI: 332 (*Salix lasiolepis-Quercus chrysolepis*/*Calycanthus occidentalis* Shrubland)
USGS–NPS Veg Data: 98M13 (alliance level only)

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### *Chamaebatia foliolosa-Arctostaphylos viscida* Dwarf-shrubland [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Mountain Misery-Whiteleaf Manzanita Dwarf-Shrubland** |
| **SYNONYM** | **none** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Needle-leaved or microphyllous evergreen dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Creeping or matted needle-leaved or microphyllous evergreen dwarf-shrubland |
| ALLIANCE | *Chamaebatia foliolosa* Dwarf-shrubland Alliance [Provisional] |
| CLASSIFICATION CONFIDENCE LEVEL | 2-1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

The association is not known beyond the boundary of the Yosemite environs. The characteristic species are restricted, in combination, to the western slopes of the Sierra Nevada.

**Yosemite and environs**

This association is known from scattered locations throughout the western low to mid elevation regions of the park and environs. Samples are from the vicinity of Wawona, (Wawona quad.), Cherry Lake (Cherry Lake North quad), and Snyder Ridge (Buckingham Mountain quad).

ENVIRONMENTAL DESCRIPTION

**Globally**

Likely to be similar to the Yosemite and environs description below.

**Yosemite and environs**

This provisional association of this provisional alliance is typically a small patch community that is found in small openings surrounded by Pin*us ponderosa-Calocedrus decurrens* stands or within larger stands of *Arctostaphylos viscida* within elevation Zone 2 of the west side of the study area. Stands are usually less than 1 acre. Elevations range from 3900-5300 feet. Stands occur on moderate to steep slopes on mid to upper and high level slopes. Aspects are mostly warm southerly to westerly (northwesterly). Soils are moderately well drained to rapidly drained on either granitic or metamorphic substrates. Soil texture ranges from sandy loam to clay loam. Litter and duff cover from 70-96 percent, large rocks and small rocks both average about 6% cover.

MOST ABUNDANT SPECIES

**Globally**

This association and alliance is only described from the Yosemite environs.

**Yosemite and environs**

| | |
|---|---|
| Sub-Shrub | *Chamaebatia foliolosa* |

CHARACTERISTIC SPECIES

**Globally**

This association and alliance is only described from the Yosemite environs.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Arctostaphylos viscida* |
| Sub-Shrub | *Chamaebatia foliolosa* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the Yosemite environs, but is likely to be similar in composition elsewhere in the Sierra Nevada.

**Yosemite and environs**

This association has scattered shrubs of *Arctostaphylos viscida* emergent (to 3 meters) over a relatively dense ground layer composed of the sticky leaved aromatic subshrub *Chamaebatia foliolosa*. The canopy is less than 1 meter in height. *Chamaebatia foliosa* is the dominant species averaging 32% but ranging up to 70% cover. The shrub *Arctostaphylos viscida* averages about 2 percent cover and is scattered over the uniform subshrub cover. Emergent saplings of *Pinus ponderosa, Quercus kelloggii,* and *Calocedrus decurrens* may be present. Herbs are sparse and include occasional *Poa secunda, Poa bolanderi, Lotus humistratus, Lolium arundinaceum, Lithophragma bolanderi, Hieracium albiflorum Gilia capitata,Galium bolanderi, Elymus glaucus, Dichelostemma capitatum, Cryptantha simulans, Claytonia perfoliata, Clarkia rhomboidea,* and *Linanthus montanus*. Exotic species are also sparse but include *Bromus tectorum, Hypochoeris glabra,* and *Aira caryophyllea*. All of these herbs average less than 1% cover apiece.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2?

RANK JUSTIFICATION This is probably of limited occurrence in the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
*Chamaebatia foliolosa* is known to proliferate through resprouting of underground runners following fire and likely prefers relatively high fire frequencies. It is usually a forest or less regularly a tall shrub understory species and is only known to dominant in very small areas (most of the 400 square meter sample plots approximately equaled the size of the stand). As an alliance and association it is probably restricted by fire history and other disturbance events and may be a short -lived transition community.

The provisional map of the environs has identified 200 polygons of this vegetation. Thus, more should be sampled and their adjacent stands and disturbance histories studied, before further resolution can be made on the validity of this alliance and association. The photointerpreters for the mapping project could see either strong dominance of *Chamaebatia foliolosa* or a combination of the Arctosta*phylos viscida* with the *Chamaebatia*. The combination of the sparse emergent tall *Arctostaphylos* and the low continuous mountain misery seems to be the likely typical expression of all stands of this alliance locally, however other combinations may exist.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99K31, 99K25, 99S38
Wieslander: **739**

FORESTS AND WOODLANDS OF ECOLOGICAL ZONES I AND II

## QUERCUS CHRYSOLEPIS FOREST ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak Forest Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter-rain evergreen sclerophyllous forest |

Stands of this alliance are found throughout cismontane California, from the northern Coast Ranges, south through the Cascade, Sierra Nevada, Transverse and Peninsular ranges into Baja California, Mexico (NatureServe 2007). Precipitation throughout the range of this alliance is strongly seasonal, with a Mediterranean pattern. Summers are warm and dry, while winters are cool and moist. Stands are found at low to mid elevations (500-1500 m) throughout the western portion of Yosemite on somewhat steep to steep slopes of varying aspect. Soils are derived from granitic or metamorphic parent material and are typically well drained sandy to silt loams on middle to upper slopes. Litter cover varies but is typically greater than 50 percent.

*Quercus chrysolepis* as the important or dominant species in the tree canopy. The canopy may be two-tiered, with emergent conifers like *Pseudotsuga menziesii*, *Calocedrus decurrens*, *Abies concolor*, *Pinus ponderosa*, and *Pinus lambertiana*. The conifer component must be minor. The main tree canopy may contain *Acer macrophyllum*, *Quercus kelloggii*, and *Umbellularia californica*. Shrubs are infrequent, but may include *Ceanothus integerrimus*, *Keckiella breviflora*, *Arctostapylos viscida*, *A. mewukka*, *Symphoricarpos mollis*, *Rubus* spp., and *Toxicodendron diversilobum*. Common understory components include *Polystichum imbricans*, *Dryopteris arguta*, *Pentagrama triangularis*, *Galium bolanderi*, *Poa secunda*, and *Vulpia myuros*. This alliance is represented locally by six associations, all defined with data from this project. It has been observed on the talus slopes on both sides of Yosemite Valley and at Lake Eleanor

USGS-NPS Veg Data:
Wieslander:

### *Quercus chrysolepis - Umbellularia californica* Forest

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak - California Laurel Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association is widespread in the Sierra Nevada south to at least Sequoia and Kings Canyon national parks.

**Yosemite and environs**

Stands of *Quercus chrysolepis – Umbellularia californica* forest are sampled in the westside mapping area of Yosemite and environs within the Lake Eleanor 7.5-minute; Yosemite and environs 15-minute, El Portal, South Cherry Lake, and Hetch Hetchy Reservoir 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Similar stands occur south to Sequoia National Park on moderate to steep slopes below 5,500 feet.

**Yosemite and environs**

Stands of *Quercus chrysolepis – Umbellularia californica* forest are found at low to midelevations (1,600–5,300 feet)
on the low to upper portions of slopes of all aspects. This association is found on somewhat steep to very steep (20–65 degrees) stony slopes. Soils tend to be stony and well drained with textures ranging from stony to silty loam of granitic, metamorphic, and igneous parent material. Soil depths are shallow to moderately deep. These sites generally experience low to moderate disturbance.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus chrysolepis* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus chrysolepis, Umbellularia californica* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis* - *Umbellularia californica* forest are dominated by *Quercus chrysolepis* in the overstory and *Umbellularia californica* in the understory tree layer, although *Umbellularia californica* is less abundant. In some stands *Quercus kelloggii* may be common (usually midelevations around 4,000–5,000 feet). In the preliminary classification, the *Quercus kelloggii* phase of this association was individuated. However, there is little justification for doing so because all other prominent species are shared. *Toxicodendron diversilobum* can be common in the shrub layer of some sites. *Dryopteris arguta* can be common in the herb layer of some sites. A variety of other species are also found in this association including *Aesculus californica, Quercus kelloggii, Pseudotsuga menziesii, Melica californica, Vulpia microstachys, Bromus tectorum, Selaginella hansenii,* and moss. This association forms a moderately dense forest with 5–20 percent cover at 0–0.5 meter tall, 5–30 percent cover at 1–2 meters tall, 10–20 percent cover at 2–5 meters tall, 20 percent cover at 5–10 meters tall, 90 percent cover at 10–15 meters tall, 40–70 percent cover at 15–20 meters tall, and 10 percent cover at 20–35 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to occur commonly in the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association is widespread in the western Yosemite mapping area and is among the most common of the *Quercus chrysolepis* associations locally.

**Plots used to describe association (n=24)**
USGS–NPS Veg Data: 99K15, 99K50, 99K13, 99K22, 98M19, 98K13, 98M11, 99K30
NRI: 12, 13, 14, 15, 22, 42, 68, 71, 72, 73, 144, 321
Wieslander: **24, 418, 420, 687**

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***Quercus chrysolepis/Arctostaphylos viscida* Forest**

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak/Whiteleaf Manzanita Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis/Arctostaphylos viscida* forest are sampled in the westside mapping area of Yosemite and environs within the Hetch Hetchy Reservoir, Buckingham Mountain, El Portal, Kinsley, and Lake Eleanor 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis/Arctostaphylos viscida* forest are found on xeric sites at low to midelevations (1,600–6,200 feet) at the low to upper portions of linear slopes of all aspects. These sites tend to be moderately steep to steep (10–36 degree slopes) with a high level of sun exposure. This association is found on poorly developed, rapidly drained to somewhat poorly drained soils that are mostly shallow but occasionally have medium depths, and textures range from stony, sandy loam to clay loam that are derived from metamorphic and granitic parent material. This association is often found on open, stony slopes with rock outcrops, benches, and granite slabs. Litter tends to be high (62–86% cover). Disturbance at these stands is usually low but can be moderate.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis*
Shrub *Arctostaphylos viscida*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis/Arctostaphylos viscida* forest are dominated by *Quercus chrysolepis* in the tree layer and *Arctostaphylos viscida* in the shrub layer. *Toxicodendron diversilobum* is also commonly found in the shrub layer. A variety of other species is found in this association, although far less common or constant, including *Pinus attenuata, Pinus ponderosa, Pinus sabiniana, Pinus coulteri, Quercus wislizeni, Aesculus californica, Arctostaphylos mewukka, Ceanothus cuneatus, Cercis canadensis* var. *texensis, Chamaebatia foliolosa, Bromus diandrus,* and *Vulpia myuros*. Other species that may be found contributing to minor cover include *Pentagramma triangularis, Galium bolanderi, Melica californica, Symphoricarpos mollis, Dryopteris arguta, Rhamnus ilicifolia (= Rhamnus crocea* ssp. *ilicifolia),* and moss. This association usually forms a two-story structure with an intermittent to continuous tree layer with 5–40 percent cover at 0–0.5 meter tall, 10 percent at 1–2 meters tall, 10–20 percent cover at 0.5–1 meter tall, 20–70 percent cover at 2–5 meters tall, 10–60 percent cover at 5–10 meters tall, 80 percent cover at 10–15 meters tall, 30–40 percent cover at 15–20 meters tall, and 5 percent cover at 35–50 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to occur throughout the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=17)**
NPS–USGS Veg Data: 98M2, 99K33, 99K35, 99K42, 99K11, 99K19
NRI: 48, 227, 315, 319, 320
Wieslander: **718, 434, 432, 152, 120, 253**

***Quercus chrysolepis/Arctostaphylos patula* Forest**

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak/Greenleaf Manzanita Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely to occur throughout the Sierra Nevada and perhaps into the Klamath Province of northwestern California.

**Yosemite and environs**
Stands of *Quercus chrysolepis/Arctostaphylos patula* forest were sampled in the low elevation westside mapping area of Yosemite and environs, most commonly within the Yosemite and environs 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis/Arctostaphylos patula* forest are generally found at midelevations (4,900–7,700 feet) on the mid to upper portions of linear to convex-shaped slopes with eastern to southern aspects. These sites tend to be on moderate to steep (9–30 degrees) slopes. Soils tend to be shallow and poorly developed with textures ranging from stony loam, to stony, gravelly loam and of granitic parent material. Penetration is medium to difficult.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis*

CHARACTERISTIC SPECIES
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus chrysolepis* |
| Shrub | *Arctostaphylos patula* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis/Arctostaphylos patula* forest form a two-story structure dominated by *Quercus chrysolepis* in the tree layer and *Arctostaphylos patula* in the shrub layer. A variety of other species found in this association, although far less common and constant, may include *Arctostaphylos viscida, Cercocarpus montanus* var. *glaber* (= *Cercocarpus betuloides* var. *betuloides*), *Calocedrus decurrens, Pinus jeffreyi, Pseudotsuga menziesii, Pinus lambertiana, Quercus kelloggii, Ceanothus cordulatus,* and *Ceanothus integerrimus.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Stands appear to be more localized than the previous two *Quercus chrysolepis* associations. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

This is the highest elevation association of the *Quercus chrysolepis* forest alliance locally.

**Plots used to describe association (n=5)**

NRI: 20, 46

Wieslander: **18, 38, 40**

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***Quercus chrysolepis – Pinus sabiniana* Forest**

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak - Gray Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis – Pinus sabiniana* forest are sampled in the lower elevation canyons of the westside mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis – Pinus sabiniana* forest are found at low to midelevations (4,100–5,100 feet) on xeric to extremely xeric sites that have southeastern to northwestern aspects. These sites tend to be on convex-shaped, moderately steep to steep (14–36 degrees) slopes. This association is typically found on stony sites with poorly developed, shallow to deep soils with textures that range from stony to sandy loam and from granitic parent material. Penetrability is easy to difficult.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus chrysolepis* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus chrysolepis, Pinus sabiniana* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus chrysolepis - Pinus sabiniana* forest form an intermittent to open three-story structure dominated by *Quercus chrysolepis* and *Pinus sabiniana* in the tree layer. Rarely found are stands with greater than 50 percent cover of *Quercus chrysolepis. Arctostaphylos viscida, Toxicodendron diversilobum,* and *Ceanothus cuneatus* are commonly found contributing variable but usually sparse cover in the shrub layer. A large variety of other species may also be found contributing to minor cover in this association including *Calocedrus decurrens, Umbellularia californica, Quercus wislizeni, Aesculus californica, Adenostoma fasciculatum, Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), *Bromus diandrus, Bromus tectorum, Linanthus montanus, Madia* sp. *Poa secunda, Vulpia microstachys, Vulpia myuros, Dichelostemma capitatum, Pseudotsuga menziesii, Rhamnus ilicifolia (= Rhamnus crocea* ssp. *ilicifolia),* and moss.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association is moderately common locally. It usually occurs at low elevation sheltered sites adjacent to relatively xeric stony locations.

**Plots used to describe association (n=8)**
USGS–NPS Veg Data: 99K23, 99K51, 99S19
Wieslander: 544, 61, 122, 71, 118

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***Quercus chrysolepis – Pinus ponderosa* Forest**

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak - Ponderosa Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis – Pinus ponderosa* forest are found in the westside of the mapping area of Yosemite and environs within the El Portal and Buckingham Mountain 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis – Pinus ponderosa* forest are found at low to midelevations (1,900–6,100 feet) on mesic to submesic sites. These sites are typically on linear, undulating, convex- and concave-shaped slopes with southern to northern aspects and are often on steep slopes (27–45 degrees). Soils tend to be shallow to well deep with textures ranging from stony, gravelly sand to clay loam from metamorphic and granitic parent material.

Drainage is well drained to rapidly drained. Litter ranges from 82–94 percent cover. Disturbance by invasion of exotics is high.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis, Pinus ponderosa, Quercus kelloggii, Pinus lambertiana*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis* - *Pinus ponderosa* forest form a three-story structure. The emergent nature of the *Pinus ponderosa* over a denser canopy of *Quercus chrysolepis* is evident in all stands sampled. The open to intermittent tree layer is dominated by *Quercus chrysolepis* and *Pinus ponderosa* although *Quercus kelloggii* and *Pinus lambertiana* are also important. *Pseudotsuga menziesii*, *Pinus attenuata*, *Calocedrus decurrens*, and *Abies concolor* are occasionally present in this association. The shrub layer is often open with predominantly *Chamaebatia foliolosa* and *Toxicodendron diversilobum.* The herb layer is open to continuous with mostly *Galium bolanderi* and *Asarum hartwegii;* however, a variety of other understory species may be found contributing to minor cover. The structure of this association consists of a 20–70 percent cover at 0–0.5 meter tall, 5–20 percent at 1–2 meters tall, 5–20 percent at 2–5 meters tall, 5 percent at 5–10 meters tall, 20–30 percent at 10–15 meters tall, and 5 percent at 35–50 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?
RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is a transitional community between the Ponderosa pine woodland alliance and the Canyon live oak forest alliance. Further sampling may determine that it is more reasonable to assign the stands classified in this association as members of the *Pinus ponderosa* woodland alliance. However, the cover of *Pinus ponderosa* relative to *Quercus chrysolepis* is low.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99K29, 99S22
Wieslander: **172**

***Quercus chrysolepis - Calocedrus decurrens* Forest**

| | |
|---|---|
| **COMMON NAME** | **Canyon Live Oak - Incense Cedar Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Winter rain broad-leaved evergreen sclerophyllous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Lowland or submontane winter rain evergreen sclerophyllous forest |
| ALLIANCE | *Quercus chrysolepis* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association occurs at least as far south as Sequoia National Park.

**Yosemite and environs**
Stands of *Quercus chrysolepis – Calocedrus decurrens* forest were sampled within the Hetch Hetchy Reservoir 15-minute and Lake Eleanor 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis – Calocedrus decurrens* forest are found at low to midelevations (4,400–5,200 feet) on southeast- to southwest-facing, moderately steep to somewhat steep (5–21 degrees) slopes.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Quercus chrysolepis, Calocedrus decurrens*

VEGETATION DESCRIPTION
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus chrysolepis* - *Calocedrus decurrens* forest form a three-story structure with an open to intermittent tree layer dominated by *Quercus chrysolepis* and *Calocedrus decurrens*. Often found in this association and contributing to less cover is *Quercus kelloggii* and *Pinus ponderosa*. Occasionally, *Umbellularia californica* is found in low cover. Rarely, *Abies concolor* is in this association. The understory shrub and herb layer are sparse and may include *Ceanothus integerrimus, Lonicera interrupta, Agoseris retrorsa, Clarkia rhomboidea, Elymus stebbinsii, Gilia capitata* ssp. *mediomontana, Keckiella breviflora, Lupinus grayi, Lupinus stiversii,* and *Symphoricarpos mollis.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Uncertain, likely to be relatively uncommon and localized.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is another transitional association between the Canyon live oak forest alliance and the Ponderosa pine – incense cedar alliance. Cover of the emergent conifers is low, while cover of the canyon live oak is relatively high. See *Calocedrus decurrens* alliance descriptions for semiriparian stands with high *Calocedrus decurrens* and relatively low cover of *Quercus chrysolepis*. Although poorly sampled, these stands are notable in ravines and along narrow steep streams in several parts of the park and environs.

**Plots used to describe association (n=3)**
NRI: 2, 3, 298

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**PINUS PONDEROSA – CALOCEDRUS DECURRENS FOREST ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Ponderosa pine-Incense-cedar ForestAlliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |

Stands of Pinus ponderosa-Calocedrus decurrens alliance occur on raised stream benches, terraces, slopes, and ridges of all aspects on deep, well-drained soils. Stands at Yosemite occur generally between 700 and 1600 m elevation on variable aspects and slope steepness. *Pinus ponderosa* and *Calocedrus decurrens* are both important in the canopy and/or the regeneration layers. Other conifers may be present, but combined *P. ponderosa* and *C. decurrens* comprise the most cover (>60 percent relative cover). Associated species may include *Abies concolor, P. jeffreyi, P. lambertiana, Pseudostuga menziesii, Quercus chrysolepis,* and *Q. kelloggii*. *Ceanothus integerrimus* is common in the sparse to intermittent shrub layer along with *Chamaetaia foliolosa*, *Arctostaphylos viscida* ssp. *mariposa*, *A. patula*, and *Ceanothus parvifolius*. Herbaceous cover is sparse to moderate. This alliance is represented locally by three associations, all defined with data from this project. It has been observed at Wawona, the western portion of Yosemite Valley, and Foresta.

USGS-NPS Veg Data: No stands sampled at alliance level

***Pinus ponderosa -Calocedrus decurrens/Chamaebatia foliolosa* Forest**

| | |
|---|---|
| **COMMON NAME** | **Ponderosa Pine – Incense Cedar/Mountain Misery Forest** |
| **SYNONYM** | |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus ponderosa - Calocedrus decurrens* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Don Potter (pers. com. 2002) has about 20 plots collected from elsewhere in the Sierra, but these have not been summarized yet.

**Yosemite and environs**
Stands of *Pinus ponderosa - Calocedrus decurrens/Chamaebatia foliolosa* forest are found throughout the lower elevation westside portion of the mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus ponderosa - Calocedrus decurrens/Chamaebatia foliolosa* forest are found in moderately xeric upland sites at midelevations (5,800–6,400 feet) on the mid to upper portions of south- to southwest-facing slopes. These sites tend to be undulating to linear and gentle to moderately steep (0–14 degrees). These sites generally have well developed (occasionally poorly developed) soils with textures ranging from stony, gravelly loam to loam of granitic parent material. Penetrability tends to be easy to moderate, and soil depths are medium to deep.

MOST ABUNDANT SPECIES
**Globally**
This association is only described from Yosemite. Information about its global characteristics is not available without additional inventory and summarization.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa, Calocedrus decurrens* |
| Shrub | *Arctostaphylos patula, Chamaebatia foliolosa* |

CHARACTERISTIC SPECIES
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa, Calocedrus decurrens* |
| Shrub | *Chamaebatia foliolosa* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus ponderosa - Calocedrus decurrens/Chamaebatia foliolosa* forest form a two-story structure with an intermittent to nearly closed tree layer dominated by *Pinus ponderosa* and *Calocedrus decurrens* and a shrub layer dominated by *Chamaebatia foliolosa* and sometimes with *Arctostaphylos patula* with highly variable cover depending on overstory cover.

CONSERVATION RANK G4?

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

This association is likely to be widespread in the central and southern Sierra Nevada.

**Yosemite and environs**

Compared to *Pinus ponderosa - Calocedrus decurrens - Quercus kelloggii* forest, this type is usually more open with a better developed shrub or subshrub understory.

**Plots used to describe association (n=6)**

NRI: 86, 299, 264,
Wieslander: **558, 705, 282**

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***Pinus ponderosa - Calocedrus decurrens – Quercus kelloggii* Forest**

| | |
|---|---|
| **COMMON NAME** | **Ponderosa Pine - Incense Cedar - California Black Oak Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus ponderosa - Calocedrus decurrens* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only described from Yosemite. Information about its global characteristics is not available without additional inventory and summary. Don Potter (pers. Com 2002) has sampled about 20 plots elsewhere in the Sierra Nevada.

**Yosemite and environs**

Stands of *Pinus ponderosa - Calocedrus decurrens – Quercus kelloggii* forest are sampled in the mapping area of Yosemite and environs within the Lake Eleanor 7.5-minute; El Capitan, El Portal, Wawona, Buckingham Mountain, and Hetch Hetchy Reservoir 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus ponderosa - Calocedrus decurrens – Quercus kelloggii* forest are found at submesic to mesic environments at low to midelevations (2,400–6,700 feet). This association is found on variable sites. This association is found on basins and low to high slopes of hills and mountains with slopes that are flat to steep (0–36 degrees). Aspect is highly variable but is mostly south facing. Soil properties vary with textures from coarse and gravelly to silt loam, and depth is shallow to deep. Penetrability is easy to moderate. Drainage is very poorly drained to well drained. Parent material is granitic. Disturbance at this association is none to moderate. Fire is a common disturbance in this association. Litter cover is usually high but ranges from 15–90 percent cover.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa, Calocedrus decurrens, Quercus kelloggii* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus ponderosa - Calocedrus decurrens – Quercus kelloggii* forest form a three-story structure with an intermittent to nearly closed tree layer that is dominated by *Pinus ponderosa, Calocedrus decurrens,* and *Quercus kelloggii.* At upper elevations, *Pinus lambertiana* is also important. *Abies concolor, Quercus vaccinifolia,* and *Pseudotsuga menziesii* are rarely present. The open understory layer is highly variable and may include *Ceanothus integerrimus, Ceanothus cordulatus, Chamaebatia foliolosa, Arctostaphylos patula, Arctostaphylos viscida, Toxicodendron diversilobum, Pteridium aquilinum, Lupinus breweri, Apocynum androsaemifolium,* and *Galium bolanderi. Carex tompkinsii* is a rare species that may be found in this association. The structure constists of a 0–80 percent cover at 0–0.5 meter tall, 5–10 percent cover at 0.5–1 meter tall, 0–20 percent cover at 1–2 meters tall, 5 percent cover at 2–5 meters tall, 10–50 percent cover at 5–10 meters tall, 10–70 percent cover at 10–15 meters tall,

20 percent cover at 15–20 meters tall, 0–40 percent cover at 20–35 meters tall, 10 percent cover at 35–50 meters tall, and 20–50 percent cover at greater than 50 meters tall.

OTHER NOTEWORTHY SPECIES
*Carex tompkinsii* is a List 4 species (CNPS 2001) found at one of the 32 plots. It usually is found in chaparral, *cis*montane woodland, lower montane coniferous forests, and upper montane coniferous forest at 1,400–6,000 feet. This plant is found within Fresno, Mariposa, and Tuolumne counties.

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to be widespread in the Sierra Nevada

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is the most closed and mesic of the locally represented Ponderosa pine-Incense cedar associations. It may range to semiriparian with an understory of *Rubus leucodermis* (blackcap raspberry). As slopes steepen, cover of the canopy opens and this association gives way to *Pinus ponderosa - Calocedrus decurrens/Chamaebatia foliolosa* forest on moderately steep and sunny slopes, and on steeper stony slopes it gives way to *Pinus ponderosa - Calocedrus decurrens - Quercus chrysolepis/Chamaebatia foliolosa* forest.

**Plots used to describe association (n=33)**
USGS–NPS Veg Data: 98K23, 98K24, 98K31, 98K65, 98M16, 98M23, 98M25, 98M5, 98K16
NRI: 80, 82, 83, 316, 267, 268, 102, 103, 17, 23
Wieslander: 540, 16, 445, 451, 452, 467, 474, 440, 57, 81, 116, 176, 46, 95

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***Pinus ponderosa - Calocedrus decurrens - Quercus chrysolepis/Chamaebatia foliolosa* Forest**

| | |
|---|---|
| **COMMON NAME** | **Ponderosa Pine - Incense Cedar - Canyon Live Oak/Mountain Misery Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus ponderosa - Calocedrus decurrens* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association occurs throughout the central and southern Sierra Nevada.

**Yosemite and environs**
Stands of *Pinus ponderosa - Calocedrus decurrens - Quercus chrysolepis/Chamaebatia foliolosa* forest are sampled in the mapping area of Yosemite and environs within the Buckingham Mountain, El Capitan, Lake Eleanor 15-minute and Lake Eleanor 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus ponderosa - Calocedrus decurrens - Quercus chrysolepis/Chamaebatia foliolosa* forest are found at submesic environments of low to midelevations (4,200–5,600 feet) on the mid to upper portions of southeast-, southwest-, to west-facing, gentle to steep (2–28 degrees) slopes. Soils are usually poorly developed and sometimes stony. Depths are shallow to medium, and textures range from stony to silt loam and of granitic parent material. Penetrability is easy to difficult. Fire is fairly frequent in this association.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa, Calocedrus decurrens, Quercus chrysolepis* |
| Shrub | *Chamaebatia foliolosa* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus ponderosa - Calocedrus decurrens – Quercus chrysolepis/Chamaebatia foliolosa* forest form open to moderately closed stands dominated by *Pinus ponderosa, Calocedrus decurrens, Quercus chrysolepis,* and *Chamaebatia foliolosa*. *Chamaebatia foliolosa* understory density is highly variable depending on the openness of the canopy. *Quercus kelloggii* is sometimes present. *Quercus kelloggii* appeares to fare better than the *Quercus chrysolepis* on the less steep and locally less rocky microsites within the stands. *Pinus ponderosa* and *Umbellularia californica* may sometimes be present in the overstory. *Toxicodendron diversilobum, Arctostaphylos patula, Arctostaphylos viscida,* and *Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*) may sometimes be present in the understory.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | Likely to be common in the central and southern Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
The putative association: *Pinus ponderosa - Calocedrus decurrens/Chamaebatia foliolosa* forest listed in the preliminary classification was incorporated into this association because of the many similarities, especially species composition.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99K34, 99K46
NRI: 299
Wieslander: **737, 438**

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***Calocedrus decurrens - Alnus rhombifolia* Forest**

| | |
|---|---|
| **COMMON NAME** | **Incense Cedar - White Alder Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Calocedrus decurrens* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Wetland, Riparian |

RANGE
**Globally**
This association is only described from Yosemite. Information about its global characteristics is not available without additional inventory. It likely occurs in other areas in the Sierra Nevada and perhaps in the Klamath Mountains of California. Don Potter (pers com 2002) has sampled approximately 74 plots in this association throughout the Sierra.

**Yosemite and environs**
Stands of *Calocedrus decurrens - Alnus rhombifolia* forest are sampled in Zones I and II of the mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Calocedrus decurrens - Alnus rhombifolia* forest are found at low elevations (4,100–5,800 feet) on the lower portions of slopes, usually along streamsides with variable aspects, and on generally concave, moderately steep to slightly steep slopes. These sites are seasonally flooded to saturated. Soils are from granitic parent

material. Sites may occur in narrow riparian corridors along small streams or on broader alluvial terraces adjacent to larger streams.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Calocedrus decurrens*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Calocedrus decurrens, Alnus rhombifolia*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Calocedrus decurrens - Alnus rhombifolia* forest are dominated by *Calocedrus decurrens* with relatively less *Alnus rhombifolia*. Rarely, *Alnus rhombifolia* is more common. Usually, *Pinus ponderosa* or *Pinus lambertiana* are present, and *Abies concolor* is occasionally present. Other species present may include *Cornus* sp., *Salix exigua, Rhododendron occidentale, Corylus cornuta,* and *Rubus parviflorus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION These stands are likely to be common throughout the central and southern Sierra Nevada but of small total acreage. Site quality outside of protected areas may be frequently diminished by logging and streambed alteration.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This type is ecologically similar to the *Alnus rhombifolia* association, where *Alnus rhombifolia* is the dominant along well watered stream channels. *Calocedrus decurrens* is the most mesophytic conifer in the low elevation westside of the Sierra and frequently overlaps with *Alnus rhombifolia* within the riparian zone.

**Plots used to describe association (n=8)**
Potter: 2030, 659, 649, 642, 662, 634, 635

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***Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* Forest**

| | |
|---|---|
| **COMMON NAME** | **Douglas-Fir - White Fir – Incense-cedar Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pseudotsuga menziesii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association occurs throughout the northern Sierra Nevada and southern Cascades (Fites, 1993) at least as far south as Yosemite Valley. Don Potter (pers com 2002) has sampled this association near Carlon. The southern range limit is probably Big Creek near Huntington Lake, Fresno County.

**Yosemite and environs**

Stands of *Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* forest are sampled within the mapping area of Yosemite and environs in the El Capitan and Half Dome 7.5 minute topographic quadrangles and in the vicinity of Hodgdon Ranch in the Tuolumne River drainage.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* forest are found at low elevations (2,100–4,800 feet) at cool, moist sites with humid air. These sites tend to occur on north- or northeast-facing, gentle to moderately steep (12–80%), lower or mid slopes. Sites are often adjacent to perennial streams generally occupying small areas. Soils are moderately deep to deep in metamorphic or volcanic substrates. Coarse fragments tend to be higher in this association. Fire is infrequent, with low to medium intensities and variable spread (Fites, 1993).

**Yosemite and environs**

Stands of *Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* forest are found at low to midelevations (4,000–6,200 feet) on the channel bed to midportion of northwest- to northeast-facing, flat to somewhat steep (0–38%) slopes. Soil are generally deep but can be shallow with textures ranging from stony to sandy, loamy clay of granitic parent material. Penetrability is easy to moderate. Litter ranges from 45–65 percent cover.

MOST ABUNDANT SPECIES

**Globally**

Tree *Pseudotsuga menziesii, Abies concolor, Calocedrus decurrens, Pinus ponderosa* (Fites, 1993)

**Yosemite and environs**

Tree *Pseudotsuga menziesii, Abies concolor, Calocedrus decurrens*

CHARACTERISTIC SPECIES

**Globally**

Tree *Pseudotsuga menziesii, Abies concolor, Calocedrus decurrens, Pinus ponderosa, Pinus lambertiana* (Fites, 1993)

Herbaceous *Adenocaulon bicolor, Trichostema lanceolatum*

**Yosemite and environs**

Tree *Pseudotsuga menziesii, Abies concolor, Calocedrus decurrens*

VEGETATION DESCRIPTION

**Globally**
Stands of *Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* forest form a dense, multilayered overstory of *Pseudotsuga menziesii, Abies concolor,* and *Calocedrus decurrens. Corylus cornuta* is in the shrub layer, and dense patches of both or either *Adenocaulon bicolor* or *Trichostema lanceolatum* are in the herb layer. *Pseudotsuga menziesii* dominates and occasionally codominates with *Abies concolor. Calocedrus decurrens, Pinus lambertiana,* and occasionally *Pinus ponderosa* are minor associates. Infrequently, *Taxus brevifolia* and *Torreya californica* are present. *Pseudotsuga menziesii* dominate the regeneration, but *Abies concolor* and *Calocedrus decurrens* can also be high or dominant. *Quercus kelloggii, Pinus lambertiana,* and *Cornus nuttallii* are common in low amounts. *Quercus chrysolepis* occurs in the overstory and midstory on sites with limiting soil conditions, either shallow and stony sites with limited rootability or very high coarse fragments. *Corylus cornuta* forms a tall shrub layer of variable cover. The herb layer is well developed with dense patches dominated by *Adenocaulon bicolor* and *Trichostema lanceolatum* (Fites, 1993).

**Yosemite and environs**
Stands of *Pseudotsuga menziesii - Abies concolor - Calocedrus decurrens* forest form a dense overstory and open understory codominated by *Pseudotsuga menziesii, Abies concolor,* and *Calocedrus decurrens* in the tree canopy and a variety of species in the understory. *Pinus lambertiana* and *Quercus kelloggii* are commonly present. *Acer macrophyllum, Quercus chrysolepis, Pinus jeffreyi, Alnus rhombifolia,* and *Umbellularia californica* may also be present. The understory shrub layer may include *Chamaebatia foliolosa, Ceanothus integerrimus,* and *Corylus cornuta.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Likely to be widespread in the northern and central Sierra Nevada, but many stands have been logged. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
The largest stands occur in the Tuolumne River drainage near Hodgdon Ranch, Hardin Flat, and Gold Arrow Road north of the north entrance of the park.

**Plots used to describe association (n=7)**
USGS–NPS Veg Data: 99K47, 99S51
Wieslander: **361, 407, 262, 134**
Potter: 660

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***Pseudotsuga menziesii - Pinus ponderosa - Calocedrus decurrens* Forest**

| | |
|---|---|
| **COMMON NAME** | **Douglas-Fir - Ponderosa Pine – Incense-cedar Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |

| | |
|---|---|
| ALLIANCE | *Pseudotsuga menziesii - Pinus ponderosa* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pseudotsuga menziesii - Pinus ponderosa - Calocedrus decurrens* forest are sampled in the mapping area of Yosemite and environs within the Cherry Lake South 7.5 minute topographic quadrangles. However, there are other stands in the area as far south as the south fork of the Merced River drainage west of Wawona.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pseudotsuga menziesii - Pinus ponderosa - Calocedrus decurrens* forest are found at mesic sites at low to midelevations (4,600–5,900 feet) on concave and linear, north- and northwest-facing, moderately steep to steep (15–60%) slopes. Soils are typically medium to deep and well developed with textures that are mostly loams but can be stony. Parent material is usually granitic but is occasionally gabbro. Penetrability is easy to medium. Fire has been generally suppressed in these areas.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pseudotsuga menziesii, Calocedrus decurrens* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pseudotsuga menziesii, Pinus ponderosa, Calocedrus decurrens* |
| Shrub | *Chamaebatia foliolosa* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pseudotsuga menziesii - Pinus ponderosa - Calocedrus decurrens* forest form a two-story structure with an intermittent tree layer dominated by *Pseudotsuga menziesii, Pinus ponderosa,* and *Calocedrus decurrens. Quercus kelloggii* and *Pinus lambertiana* are also usually present in the tree layer. *Abies concolor* can be found contributing to minor cover at higher elevations. *Chamaebatia foliolosa* is often dominant in the shrub layer.

*Toxicodendron diversilobum*, *Ceanothus integerrimus*, *Ceanothus* sp., *Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), and *Arctostaphylos patula* may be present in the shrub layer.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Likely to be widespread in the northern and central Sierra Nevada, but many stands have been logged.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99S26
Wieslander: **150, 144, 166, 175**

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***Pseudotsuga menziesii - Quercus chrysolepis* Forest**

| | |
|---|---|
| **COMMON NAME** | **Douglas-Fir - Canyon Live Oak Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pseudotsuga menziesii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is also known from the Shasta–Trinity National Forest in the Klamath Province of northwestern California (Taylor and Teare 1979).

**Yosemite and environs**
Stands of *Pseudotsuga menziesii - Quercus chrysolepis* forest were sampled within the Half Dome and El Capitan 7.5-minute topographic quadrangles. Particularly noticeable are the stands on the Wawona Road just below the Inspiration Point tunnel.

ENVIRONMENTAL DESCRIPTION
**Globally**
According to Taylor and Teare (1979) this association is the most widespread in their study area, occurring at low elevations (below 4,500 feet) on north-facing slopes, but shifting to southerly exposures at higher elevations (between 4,500 and 5,500 feet). The substrate is all pre-Cretaceous metamorphic rock, and the soils are largely Sheetiorn–Josephine complex with annual precipitation averaging about 40 inches (1,018 mm).

**Yosemite and environs**
Stands of *Pseudotsuga menziesii - Quercus chrysolepis* forest are found at mesic site with some cold air drainages, on low to midelevations (4,000–5,300 feet). It is generally restricted to steep canyons along Yosemite Valley and the Hetch Hetchy Reservoir. Aspects are generally northerly but can be trending south (northeast to west) at its highest elevations in semiprotected locations above the Yosemite Valley. Often associated with riparian drainages, these sites are on moderate to somewhat steep (6–26 degrees), convex slopes. Soil development is minimal with shallow to medium depths, and textures are mostly stony but range from stony to clay and of granitic parent material. Penetrability is easy to difficult.

MOST ABUNDANT SPECIES
**Globally**
This association has been described by Taylor and Teare (1979). However, their description only includes stands in the southern Klamath Province. There, in addition to the abundant *Pseudotsuga menziesii* and *Quercus chrysolepis,* other species such as *Arbutus menziesii* and *Acer macrophyllum* are common, while they are rare or absent in the local stands of this association.

**Yosemite and environs**
Tree *Pseudotsuga menziesii, Quercus chrysolepis*

CHARACTERISTIC SPECIES
**Globally**
Similar stands have been described by Taylor and Teare (1979) with Pseudotsuga menziesii and Quercus chrysolepis as characteristic. However, these stands differ somewhat from the local Yosemite stands (see abundant species category above). Thus this association may actually be different despite the similarity of the two main species.

**Yosemite and environs**
Tree *Pseudotsuga menziesii, Quercus chrysolepis*

VEGETATION DESCRIPTION
**Globally**
These stands as defined in the Klamath Ecoregion by Taylor and Teare (1979) but these differ somewhat from the local Yosemite stands (see abundant species category, above). Thus, this association may actually be found to be different although the two main species are the same.

**Yosemite and environs**
Stands of *Pseudotsuga menziesii - Quercus chrysolepis* forest are dominated by *Pseudotsuga menziesii* and *Quercus chrysolepis*. *Calocedrus decurrens, Umbellularia californica, Pinus ponderosa,* and *Quercus kelloggii* are often present in the tree canopy. Other species that may be present include *Abies concolor, Alnus rhombifolia, Alnus incana, Acer macrophyllum, Cornus nuttallii, Rhododendron occidentale, Toxicodendron diversilobum, Ceanothus integerrimus, Corylus cornuta, Arctostaphylos viscida, Arctostaphylos patula,* and *Pteridium aquilinum.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION High-quality old growth stands are relatively uncommon as a result of logging and improper fire regimes.

DATABASE CODE To be determined

COMMENTS
**Globally**
See Taylor, D.W., and K.A. Teare. 1979. Ecological survey of the vegetation of the proposed Trelorita Research Natural Area, Shasta–Trinity National Forest, Trinity County, California. Unpublished report. U.S. Forest Service, Pacific Southwest Research Station, Berkeley, CA.

**Yosemite and environs**
Often on steep stabilized talus at the base of north-facing cliffs in Yosemite Valley.

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98M22
NRI: 146, 147, 148, 34
Wieslander: **437, 449, 450, 453, 354**

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**QUERCUS KELLOGGII FOREST ALLIANCE [PROVISIONAL]**

| | |
|---|---|
| **COMMON NAME** | **California Black Forest Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed broad-leaved evergreen - cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed broad-leaved evergreen - cold deciduous Forest |

This alliance is currently known only from Yosemite. Stands of this forest type are found at low to mid elevations (1150-2150 m) throughout the western portion of Yosemite on slopes of varying steepness and aspect. Soils are derived from granitic or metamorphic parent material. Litter cover is generally high. *Quercus kelloggii* is the major tree in the canopy; there may be emergent conifers present (< 10%), but *Q. kelloggii* is the dominant tree (> 50% relative cover) in stands of this alliance. Various montane tree and shrub species may be present, including *Calocedrus decurrens*, *Abies concolor*, *Pinus lambertiana*, *Ceanothus integerrimus*, *Prunus emarginata*, *Chrysolepis sempervirens*, and *Chamaebatia foliolosa*. Several stands have been sampled that show some variation in understory beyond defined associations including stands with *Pteridium aquilinum* (bracken fern), stands in rocky low elevation sites with *Aesculus californica* (California buckeye), *Cercarpus montanus* var. *glaber* (*C. betuloides*, Hickman 1993 nomenclature, birchleaf mountain mahogany), and emergent *Pinus sabiniana* (gray pine). None have sufficient sample sizes to define associations but the first, for example, has been observed at Hodgdon Meadow and Yosemite Valley.

USGS-NPS Veg Data: 98K17, 99S21 (alliance level only)
Wieslander: 541 (alliance level only)

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***Quercus kelloggii/Arctostaphylos mewukka - Chamaebatia foliolosa* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **California Black Oak/Indian Manzanita – Mountain Misery Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed broad-leaved evergreen - cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed broad-leaved evergreen cold deciduous forest |
| ALLIANCE | *Quercus kelloggii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association ranges from the northern to the southern Sierra Nevada including Sequoia and King Canyon national parks.

**Yosemite and environs**

Stands of *Quercus kelloggii/Arctostaphylos mewukka - Chamaebatia foliolosa* forest are sampled in the mapping area of Yosemite and environs within the Buckingham Mountain and Ascension Mountain 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus kelloggii/Arctostaphylos mewukka - Chamaebatia foliolosa* forest are found at low elevations (3,800–4,500 feet) on the upper portions of southeast- to west-facing, moderately steep to somewhat steep (6–25 degrees) slopes of canyons and ridges. Landform is variable; sites are located on linear, convex, and undulating slopes, ridges, and canyons. Soil textures range from loamy sand to silt loam and of granitic parent material. Soils are moderately well drained to well drained. Litter is high with 75–80 percent cover.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus kelloggii* |
| Shrub | *Arctostaphylos mewukka, Chamaebatia foliolosa* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus kelloggii* |
| Shrub | *Arctostaphylos mewukka, Chamaebatia foliolosa* |
| Herb | *Galium bolanderi, moss* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus kelloggii/Arctostaphylos mewukka - Chamaebatia foliolosa* forest form a three-story structure with an open to intermittent tree layer that is dominated by *Quercus kelloggii. Calocedrus decurrens, Pinus ponderosa,* and *Pinus attenuata* are sometimes found contributing minor cover in the tree layer. *Chamaebatia foliolosa* and *Arctostaphylos mewukka* are dominant in the open to intermittent shrub layer. *Arctostaphylos viscida* is often present. *Adenostoma fasciculatum* is occasionally found in this association as well. *Galium bolanderi* and moss are usually found in the open to intermittent herb layer. A large variety of other species are also found in this association, contributing little cover in the understory including *Agoseris grandiflora, Poa secunda, Toxicodendron*

*diversilobum, Lathyrus sulphureus, Vulpia microstachys, Ceanothus integerrimus, Ceanothus cuneatus,* and *Comandra umbellata* ssp. *californica.* The structure of this association consists of a 5–50 percent cover at 0–0.5 meter tall, 10–20 percent cover at 1–2 meters tall, 5–40 percent cover at 2–5 meters tall, 5–30 percent cover at 5–10 meters tall, and 10–20 percent cover at 10–15 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Stands are relatively small and scattered in the area and likely elsewhere in its range.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Some confusion exists between the identification of *Arctostaphylos viscida* and *Arctostaphylos mewukka*. Thus, some stands probably contain both species, while others may only contain one or the other. In general, these stands occur at the interface between Zone I and Zone II where chaparral gives way to forests of California black oak. Fire frequency is relatively high in these stands, and the individual oaks are often multistemmed.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99S23, 99S25, 99S37

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***Quercus kelloggii/Arctostaphylos patula* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Black Oak/Greenleaf Manzanita Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed broad-leaved evergreen - cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed broad-leaved evergreen - cold deciduous forest |
| ALLIANCE | *Quercus kelloggii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found in the Sierra Nevada from Tulare to Sierra counties (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus kelloggii/Arctostaphylos patula* forest are sampled in the mapping area of Yosemite and environs within the Yosemite 15-minute and White Chief Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**

Stands of *Quercus kelloggii/Arctostaphylos patula* forest are found at low to midelevations (4,600–7,100 feet) on west- and south-facing slopes that are primarily less than somewhat steep (< 20 degrees). Soil textures are usually loams and are often from granitic and sometimes andesitic parent material (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus kelloggii/Arctostaphylos patula* forest are found at midelevations (5,000–6,000 feet) on southwest- and north-facing slopes that are somewhat steep to abrupt (15–90 degrees). Soils are poorly developed with textures ranging from stony to sandy loam and are commonly from granitic parent material. Exposed bedrock can consist of 35 percent cover with 15 percent cover for large rock and 15 percent cover for small rocks. Litter cover is generally 20 percent.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Quercus kelloggii* |
| Shrub | *Arctostaphylos patula, Ceanothus cordulatus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | Quercus kelloggii |
| Shrub | Arctostaphylos patula, Ceanothus cordulatus |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Quercus kelloggii, Calocedrus decurrens* |
| Shrub | *Arctostaphylos patula, Ceanothus cordulatus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus kelloggii, Calocedrus decurrens* |
| Shrub | *Arctostaphylos patula, Ceanothus cordulatus* |

VEGETATION DESCRIPTION
**Globally**
Stands of *Quercus kelloggii/Arctostaphylos patula* forest are dominated by *Quercus kelloggii* in the tree layer with an understory shrub layer of *Arctostaphylos patula* and *Ceanothus cordulatus*. *Calocedrus decurrens* may also be quite common in this association. Other species may include *Abies concolor, Pinus ponderosa, Pinus jeffreyi, Ceanothus integerrimus, Prunus emarginata, Chrysolepis sempervirens (= Castanopsis sempervirens), Chamaebatia foliolosa,* and *Arctostaphylos mewukka.* Rarely occurring are *Pseudotsuga menziesii, Quercus chrysolepis, Quercus vaccinifolia, Amelanchier utahensis, Arctostaphylos viscida* ssp. *mariposa (= Arctostaphylos mariposa), Ceanothus prostratus, Garrya fremontii, Philadelphus lewisii,* and *Symphoricarpos mollis.* Most of the tree species in this association have a dbh between four–11 inches, and some of the tree species have a dbh of 12–23 inches. This association is found at low to midelevations (4,600–7,100 feet) on west- and south-facing slopes primarily less than 35 percent. Soil textures are usually loams and are commonly from granitic and sometimes andesitic parent material (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus kelloggii/Arctostaphylos patula* forest form a three-story structure that is dominated by *Quercus kelloggii* in the open tree layer with an intermittent understory shrub layer of *Arctostaphylos patula* and *Ceanothus cordulatus*. *Calocedrus decurrens* may also be quite common in this association. *Chrysolepis sempervirens* is sometimes common. Other species that may contribute to minor cover vary but may include *Chamaebatia foliolosa, Rosa spithamea, Abies concolor, Aspidotis californica, Cistanthe monosperma, Claytonia perfoliata, Collinsia linearis, Comandra umbellata, Galium aparine, Hydrophyllum occidentale, Linanthus ciliatus, Lithophragma parviflorum, Madia minima,* and *Penstemon newberryi.* The structure of this association consists of approximately 10–15 percent cover at 5–10 meters tall, 5 percent cover at 2–5 meters tall, 40 percent cover at 0.5–1 meter tall, and 5 percent cover at 0–0.5 meter tall.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Stands are likely to be seral and transcend to other vegetation types depending on fire frequency. The average acreage and density of stands throughout the range of this type is probably relatively low in many areas (where natural fire has been suppressed) compared to pre-European fire history over the past several hundred years. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
Locally sampled stands appear to be recent post-fire, with relatively open canopies and regenerating (resprouting) subcanopies of California black oak and other species. It is likely that this association occurs in relatively poor soils of the upper elevation zone for California black oak and is maintained by relatively frequent burning that eliminates the dominance of conifers. Formally, according to USNVC standard, the stands should mostly be considered woodlands rather than forests. However, in lieu of defining a new woodland *Quercus kelloggii* alliance we have elected to maintain this association within the already established California Black Oak alliance.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99K39
NRI: 150
Wieslander: **181**

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***Quercus kelloggii - Calocedrus decurrens* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **California Black Oak - Incense Cedar Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen-deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed broad-leaved evergreen - cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed broad-leaved evergreen - cold deciduous forest |
| ALLIANCE | *Quercus kelloggii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association ranges throughout the Sierra Nevada.

**Yosemite and environs**
Stands of *Quercus kelloggii - Calocedrus decurrens* forest are sampled in the mapping area of Yosemite and environs within the Yosemite, Lake Eleanor, and Hetch Hetchy Reservoir 15-minute topographic quadrange and the Lake Eleanor, Cherry Lake South, and Buckingham Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus kelloggii* - *Calocedrus decurrens* forest are found at dry mesic to mesic sites at low to midelevations (3,900–5,400 feet) on the mid portion of south- to north-facing, moderate to somewhat steep (12–23 degrees) slopes. Soils are moderately developed to stony and tend to be moderately well drained to well drained with textures ranging from loam to silt loam of metamorphic and granitic parent material. Litter cover is high (80–95% cover). Disturbance is usually low.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus kelloggii* |
| Shrub | *Chamaebatia foliolosa* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus kelloggii, Calocedrus decurrens* |
| Shrub | *Chamaebatia foliolosa* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus kelloggii* - *Calocedrus decurrens* forest form an intermittent tree layer which is dominated by *Quercus kelloggii* and *Calocedrus decurrens* in the overstory and *Chamaebatia foliolosa* in the understory. Rarely are *Abies concolor, Pinus ponderosa, Pseudotsuga menziesii,* and *Quercus chrysolepis* present. A variety of other species may be present contributing to minor cover including *Arctostaphylos patula, Toxicodendron diversilobum, Ceanothus integerrimus, Arctostaphylos mewukka, Galium bolanderi,* and *Galium aparine.* The structure of this association consists of a 5 percent cover at 20–35 meters tall, 40–60 percent cover at 10–15 meters tall, 5 percent cover at 5–10 meters tall, and an intermittent to continuous shrub layer with 20 percent cover at 2–5 meters tall and 20–70 percent cover at 0–0.5 meters tall. The herb layer is sparse with 5–10 percent cover at 0–0.5 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

It is likely that this is a mesic version of the California black oak alliance, which is being invaded by the shade-tolerant and relatively mesophytic *Calocedrus decurrens*. It likely results from a post-fire recovery in relatively productive settings.

**Plots used to describe association (n=9)**
USGS–NPS Veg Data: 99S29, 99S36, 98M20
NRI: 10, 149, 265, 41, 25, 70

---

***Alnus rhombifolia* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Alder Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous forest |
| ALLIANCE | *Alnus rhombifolia* Temporarily Flooded Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Wetland: Riverine, Palustrine, and Estuarine |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Don Potter (pers com 2002) has about 71 plots resembling this association collected from the Moculumne River to Lake Isabella but has not described them. Potter suggests that this association ranges throughout the western slope of the Sierra Nevada.

**Yosemite and environs**
Stands of *Alnus rhombifolia* forest were sampled within the Wawona, Cherry Lake South, and El Capitan 7.5 minute topographic quadrangles. Potter also has one plot for this association, located at the west-central portion of Yosemite near Mather.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Potter (2000 MS) describes an *Alnus rhombifolia/Darmera peltata* association that is largely found north of the mapping area. This association is similar to the one currently described locally, without the constant characteristic species *Darmera peltata*.

**Yosemite and environs**
Stands of *Alnus rhombifolia* forest are found at low to midelevations (4,400–5,000 feet) on concave, hummocky and undulating, southeast- to north-facing, flat to moderately steep (0–20%) slopes. These sites tend to be along drainages, floodplains, or streambeds that are intermittently flooded to permanently flooded. In general, *Alnus rhombifolia* stands require permanent moisture, whether subterranean or on the surface. Along intermittent streams, the stands are associated most regularly with deeper pools or stretches of more permanently flooded substrate. Soils are generally stony (10–40% large rocks, 1–15% small rocks, 1–10% sand) with textures ranging from sand to sandy loam and of granitic parent material. Soil is somewhat poorly to rapidly draining. Litter cover is 18–50 percent and water cover is 1–20 percent. Wood cover is 12–20 percent. Disturbance other than fluvial processes is low to medium.

MOST ABUNDANT SPECIES

**Globally**
This association is only described from Yosemite. However, Potter (pers com 2002) suggests that *Alnus rhombifolia* is the most abundant tree with *Darmera peltata* and several *Carex* species as the most conspicuous (if not aboundant) herbs.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Alnus rhombifolia* |
| Shrub | *Cornus nuttallii* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Alnus rhombifolia, Abies concolor, Calocedrus decurrens* |
| Shrub | *Cornus nuttallii* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.
**Yosemite and environs**
Stands of *Alnus rhombifolia* forest are found forming an intermittent to continuous canopy which is dominated by *Alnus rhombifolia* in narrow bands often associated with perennial steams. *Calocedrus decurrens* is often an important codominant tree. *Cornus nuttallii* and *Abies concolor* are usually present. Other species that may be found in this association include *Adenocaulon bicolor, Rubus parviflorus, Claytonia perfoliata (= Montia perfoliata), Galium aparine, Pteridium aquilinum, Athyrium filix-femina,* and *Boykinia major*. *Dryopteris arguta* may be common at some sites. *Carex tompkinsii* is a rare species that may be found in this association. Anecdotal information suggests that the shrubs *Corylus cornata, Rhododendron occidentalis, Rubrus parviflora,* and *Cornus stolonifera* may also be conspicuous in some stands. The structure of this association consists of 5–50 percent cover at 20–35 meters tall, 5–70 percent cover at 10–15 meters tall, 0–10 percent cover at 5–10 meters tall, and 10–80 percent cover at 2–5 meters tall. The shrub layer is open to continuous with 0–10 percent cover at 2–5 meters tall, 5–10 percent cover at 1–2 meters tall, and 5–80 percent cover at 0.5–1 meter tall. The herb layer is open with up to 40 percent cover at 0–0.5 meters tall.

OTHER NOTEWORTHY SPECIES
*Carex tompkinsii* is a List 4 species (CNPS 2001) found at one of the 32 plots. It usually is found in chaparral, *cis*montane woodland, lower montane coniferous forests, and upper montane coniferous forest at 1,400–6,000 feet. This plant is found within Fresno, Mariposa, and Tuolumne counties.

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
As a result of sampling strategy and of the dynamic nature of this vegetation, estimates of tree cover vary widely. This association is modally considered a forest type because the most extensive stands, associated with stretches of streams that are moderately to lightly disturbed by natural flooding events, maintain a relatively dense canopy of trees. *Darmera peltata* is rare south of the central Sierra Nevada; thus, this association is probably the southern and central Sierran analog to that Potter (2000) type.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 98M37, 99K28, 99K40, 98M30
Potter: 661, 331

***Populus balsamifera* ssp. *trichocarpa*/( *Rhododendron occidentale*) Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Black Cottonwood/(Western Azalea) Forest** |
| **SYNONYM** | **Black Cottonwood Series (Sawyer and Keeler-Wolf 1995, in part)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous forest |
| ALLIANCE | *Populus balsamifera* ssp. *trichocarpa* Temporarily Flooded Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
A very closely related type, *Populus balsamifera* ssp. *trichocarpa* Association is found throughout the central and southern Sierra Nevada (Potter, 2005).

**Yosemite and environs**
Within the study area, this association is known currently only from the Yosemite Valley.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. The closely related *Populus balsamifera* ssp. *trichocarpa* Association (Potter, 2005) occurs between 5,000 and 7,000 feet along second, third, and fourth order streams between 15 and 50 feet wide within narrow valleys. It is found on stream banks, mid channel bars, and flood-prone areas adjacent to banks that are hummocky with boulders.

**Yosemite and environs**
This association was found at approximately 4,000 feet elevation on valley floors adjacent to perennial streams. Slopes are gentle with a southerly aspect. Soils are permanently flooded and are sandy loams derived from granite.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Specific information about its global characteristics is not available without additional inventory. Abundant species in the closely related *Populus balsamifera* ssp. *trichocarpa* Association (Potter, 2005) include *Populus balsamifera* ssp. *trichocarpa* and *Alnus rhombifolia* in the tree layer and *Alnus incana* ssp. *tenuifolia*, *Salix exigua* in the shrub layer.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus balsamifera* ssp. *trichocarpa* |
| Shrub | *Rhododendron occidentale* |

CHARACTERISTIC SPECIES
**Globally**

This association is only known from the vicinity of Yosemite. Specific information about its global characteristics is not available without additional inventory. Characteristic species in the closely related *Populus balsamifera* ssp. *trichocarpa* Association (Potter, 2005) include *Populus balsamifera* ssp. *trichocarpa*.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus balsamifera* ssp. *trichocarpa* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory. The closely related *Populus balsamifera* ssp. *trichocarpa* Association (Potter, 2005) includes conifers as tall as 45 m mixed with a moderately dense layer of *Populus balsamifera* ssp. *trichocarpa* which ranges from 3-25 m in height. Tree cover normally exceeds 50 percent; *Alnus incana* ssp. *tenuifolia* or *Cornus sericea* may dominate the shrub layer. The well developed herbaceous layer with wetland species predominating. These may include *Equisetum arvense*, *Artemisia douglasiana*, *Aquilegia formosa*, *Elymus glaucus*, and *Poa pratensis*.

**Yosemite and environs**

This forest forms an open canopy between 20–35 meters in height. *Populus balsamifera* ssp. *trichocarpa* dominates the canopy with 26 percent cover, while *Alnus rhombifolia* contributes another 15 percent cover to the canopy or subcanopy. Emergent coniferous species such as *Calocedrus decurrens* or *Pinus ponderosa* may contribute scant cover. *Rhododendron occidentale* is the most common shrub (2.5% cover). Other common shrub associates may include *Salix lutea* (1.25% cover) and/or *Artemisia douglasiana* (0.5% cover). Many graminoids are present. *Calamagrostis canadensis* provides the most cover (18.75%), but the genus *Carex* has many representatives that combine for a few percent of cover. Species may include *Carex pellita*, *Carex feta*, *Carex lenticularis*, *Carex amplifolia*, and/or *Carex vesicaria*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

Potter (2005) describes a very similar *Populus balsamifera* ssp. *trichocarpa* Association that shares several overstory and understory dominants as well as environmental setting.

**Yosemite and environs**

More stands of this vegetation need to be sampled. However, it is distinct in Yosemite Valley. Further sampling may determine that it is more reasonable to assign the stands classified in this association as members of the *Populus balsamifera* ssp. *trichocarpa* Association of Potter (2005).

**Plots used to describe association (n=2)**

USGS–NPS Veg Data: 99S49, 99K49

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## *FRAXINUS LATIFOLIA* SEASONALLY FLOODED FOREST ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Oregon Ash Seasonally Flooded Forest Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |

| | |
|---|---|
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded cold deciduous forest |

Two associations in this alliance are defined by Potter (2000; unpublished manuscript) plots (see Methods in Section II). This alliance is represented in the mapping area by small, scattered stands at low elevation along the Merced River. It was limited, according to samples available and field reconnaissance, to the lower west side of the mapping area. Stands are usually in or immediately adjacent to active river channels and may include Cephalanthus occidentalis (buttonbush, buttonwillow) and Vitis californica (California wild grape). In addition to the Potter plots, two unclassified alliance-level samples were collected. Further sampling is required.

USGS–NPS Veg Data: 99S40, 99S41 (alliance level only)

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### *QUERCUS LOBATA* WOODLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Valley Oak Woodland Alliance** |
| **SYNONYM** | **California Valley Oak Series (Allen et al., 1991)** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |

Associations from this alliance were not defined in this project due to an insufficient number of stands. In California, this alliance is found in fresh water floodplains where the soils are intermittently flooded and seasonally saturated. Valley oak woodland communities generally occur on rich loam soils of valleys and foothills (Allen et al., 1991). Upper elevation expressions of this alliance occur on slopes generally less than 35% and on all aspects (Allen et al., 1991). In uplands, it occurs in valley bottoms, gentle slopes, and summit valleys. This alliance may include Quercus wislizeni, Q. douglasii, and/or Q. kelloggii in the stands. This alliance is of very limited extent in the study area and apparently restricted to flats and stream terraces along the Merced River below 610 m (2000 ft.). Three unclassified alliance-level samples were taken. Further sampling is required.

USGS–NPS Veg Data: 98K9, 99S4, 99S18 (alliance level only)

The Valley Oak Woodland Alliance is found in the following regions: Northern California Coast Ranges, Central California Coastal Ranges, Great Valley, Klamath Mountains, Sierra Nevada Foothills, and Southern California Coast at elevations between sea level-775 m (Allen et al., 1991).

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### *SALIX LAEVIGATA* TEMPORARILY FLOODED WOODLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Red Willow Temporarily Flooded Woodland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |

Associations from this alliance were not defined in this project due to an insufficient number of stands. However, within the study area, this alliance typically consisted of small stands along low gradient rivers and streams below 900 m (3000 ft.), for example along the Merced River west of the park boundary. Subcanopies may *Cercis*

*candensis* var. *texensis*, *Toxicodendron diversilobum*, and *Vitis californica*. Understories may be dominated by *Bromus* spp. Several unclassified alliance-level samples were taken. Further sampling is required.

USGS–NPS Veg Data: 99S39, 99S42 (alliance level only)

The red willow alliance is found in southern Utah and California. It likely occurs in southern Oregon, Arizona, and northern Nevada (NatureServe 2007). Communities within this alliance are characterized as cold-deciduous, temporarily flooded woodlands. They are found along drainages in habitats that are seasonally flooded and saturated with freshwater along floodplains, lake edges, and low-gradient rivers. The tree subcanopy may include *Fraxinus velutina* and *Alnus rhombifolia*. Elevations range from sea level to 1700 m in California.

---

***Pinus attenuata/Arctostaphylos viscida* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Knobcone Pine/Whiteleaf Manzanita Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen Woodland |
| ALLIANCE | *Pinus attenuata* Woodland Alliance |

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Don Potter (pers com 2002) has sampled this association elsewhere in the central Sierra Nevada.

**Yosemite and environs**
Stands of *Pinus attenuata/Arctostaphylos viscida* woodland are found throughout the western lower elevation portions of the mapping area of Yosemite and environs. Samples have been taken within the Kinsley, Buckingham Mountain, and El Portal 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus attenuata/Arctostaphylos viscida* woodland are found at xeric to dry mesic sites at low elevations (900–2,900 feet) on the upper slopes and ridge tops of variable but mostly southeast- to west-facing, gentle to somewhat steep slopes. The shapes of slopes are highly variable. Soils are moderately developed to well developed with textures ranging from silt loam to clay loam from metamorphic and granitic parent materials. Soils are moderately well drained to well drained. Litter cover is 70–80 percent. Disturbance levels can be low to high and include competition from exotics, road/trail construction, and vandalism/litter. Fire is also a common disturbance.

MOST ABUNDANT SPECIES
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus attenuata* |
| Shrub | *Arctostaphylos viscida* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus attenuata* |
| Shrub | *Arctostaphylos viscida* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus attenuata/Arctostaphylos viscida* woodland are dominated by an open layer of *Pinus attenuata* in the overstory with an often dense understory shrub layer dominated by *Arctostaphylos viscida.* Often found in the shrub layer are *Adenostoma fasciculatum* and *Chamaebatia foliolosa*. Where *Arctostaphylos viscida* is more open, *Chamaebatia foliolosa* often becomes an extensive ground cover. Occasionally, present are *Pinus ponderosa, Quercus kelloggii, Vulpia myuros,* and *Arctostaphylos mewukka*. Other species that may contribute to cover include *Quercus douglasii, Toxicodendron diversilobum, Ceanothus cuneatus, Dichelostemma capitatum, Sanicula bipinnata,* and *Filago* sp. The structure of this association consists of 5 percent cover at 0–0.5 meter tall, 0–5 percent cover at 0.5–1 meter tall, 20–80 percent cover at 1–2 meters tall, 40–80 percent cover at 2–5 meters tall, 5–20 percent cover at 5–10 meters tall, 20–30 percent cover at 10–15 meters tall, and 0–10 percent cover at 15–20 meters tall.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3 |
| RANK JUSTIFICATION | Likely to be scattered throughout the western Sierra Nevada and Klamath Province but not extensive. Conditions for ultimate development are strongly dependent upon fire regime. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

Locally the ridge top locations for this association suggest relatively intense fires of moderate frequency are necessary for its maintenance. More samples are needed to verify this association.

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99S10, 99S32, 98M6

## PINUS PONDEROSA WOODLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Ponderosa pine Woodland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |

Stands of *Pinus ponderosa* occur broadly across low to middle montane zones in California from near the coast to the Sierra Nevada, Cascades, and Great Basin (NatureServe 2007). *Pinus ponderosa* is dominant or equally important in the tree canopy. Stands commonly have other conifers or hardwoods present and may have well-developed shrub layers. Stands are found at lower elevations in the western portion of the Yosemite mapping area. They occur on low to high slopes on variable aspects with loamy soils generally between 500 and 1200 ft. Associated species in the main canopy may include *Quercus kelloggii*, *Q. chrysolepis*, *Calocedrus decurrens*, *Pinus lambertiana*, and *P. sabiniana*. Shrub layer is typically intermittent. Important shrub species may include *Arctostaphylos viscida* ssp. *viscida*, *Ceanothus integerrimus*, *C. parvifolius*, *C. cuneatus*, *Cercocarpus montanus* var. *glaber* (=*C. betuloides* var. *betuloides*), and *Chamaebatia foliolosa*. Herbaceous layer may be sparse to moderately dense. This alliance is represented locally by one association defined with data from this project. It has been observed along California state highway 120 west of the Yosemite National Park boundary and along Evergreen Road.

USGS-NPS Veg Data: No stands sampled at alliance level

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***Pinus ponderosa - Quercus kelloggii/Arctostaphylos viscida* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Ponderosa Pine - California Black Oak/Whiteleaf Manzanita Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus ponderosa* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Don Potter (Pers com., 2002, unpublished data) has about 10 plots with no descriptions.

**Yosemite and environs**
Stands of *Pinus ponderosa - Quercus kelloggii/Arctostaphylos viscida* woodland are found at low elevations on the west slope and have been sampled within the Lake Eleanor 7.5-minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus ponderosa - Quercus kelloggii/Arctostaphylos viscida* woodland are found at relatively xeric sites at low elevations (1,700–4,500 feet) on the low to high portions of mostly south- to southwest-facing (and occasionally northeast-facing at the lowest elevations), gentle to moderately steep (7–16 percent degrees), mostly linear mountain slopes. Soils are poorly developed and fairly stony with textures ranging from sandy loam to clay loam from metamorphic and granitic parent materials. Soils are somewhat poorly drained to well drained. Litter is high with 75–95 percent cover.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa* |
| Shrub | *Arctostaphylos viscida* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus ponderosa, Quercus kelloggii* |
| Shrub | *Arctostaphylos viscida* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus ponderosa - Quercus kelloggii/Arctostaphylos viscida* woodland are dominated by *Pinus ponderosa* in the open to intermittent overstory tree layer and *Arctostaphylos viscida* in the open to continuous understory shrub layer. Often present in the overstory are *Pinus lambertiana* and *Quercus kelloggii*. *Pinus attenuata* and *Quercus wislizeni* may occasionally be found contributing minor cover. Often in the shrub layer is *Toxicodendron diversilobum*. *Bromus diandrus, Galium parisiense, Hypochaeris glabra,* and *Vulpia myuros* are common. *Quercus kelloggii* in either seedling, sapling (shrubby), or tree form is a constant, although at usually relatively low cover. A variety of other species may also be found contributing minor cover including *Comandra umbellata* ssp. *californica, Bromus hordeaceus, Chamaebatia foliolosa, Clarkia purpurea, Eriogonum nudum, Lessingia leptoclada, Lotus unifoliolatus* var. *unifoliolatus, Streptanthus tortuosus, Stephanomeria virgata,* and *Trifolium wormskioldii.* This association has approximately 5 percent cover at 0–0.5 meter tall, 30 percent cover at 0.5–1 meters tall (herbs), 5 percent cover at 0.5–1 meters tall (shrubs), 50–70 percent cover at 1–2 meters tall, 20 percent cover at 2–5 meters tall, 40 percent cover at 2–5 meters tall (trees), 10 percent cover at 5–10 meters tall, and 10–40 percent cover at 20–35 meters tall.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | This association is likely to occur throughout the Sierra Nevada and perhaps elsewhere in northern California. |

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is the first expression of Zone II to occur in the study area. It usually is first encountered on north-facing slopes below 2,000 feet elevation in relatively mesic conditions adjacent to stands of *Quercus wislizeni* alliance or various chaparrals.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98M10, 98M9, 99K20
NRI: 318
Wieslander: **681**

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***PINUS SABINIANA* WOODLAND ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Gray Pine Woodland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |

The *Pinus sabiniana* alliance is known only from California. It occurs in the Northern and Central California Coast Ranges, the margins of the Sacramento Valley, the inner Klamath Range and foothills, the Cascade and Sierra Nevada Foothills, the Transverse Range, the Modoc Plateau, and western Mojave Desert (NatureServe 2007). This alliance can be found on sites that can be intermittently flooded with fresh water, but more typically it occurs on shallow, infertile, moderately to excessively drained soils between 300 and 2100m. The soil surface may be covered with stones and rock outcrops.

Locally, this alliance occurs on shallow, infertile, rocky soils below approximately 1250 m. It is represented locally by four associations, all newly defined in this project. The described associations are arranged along a topographic gradient with *Pinus sabiniana-Quercus wislizeni/Arctostaphylos viscida* association occurring on cooler, gentle to steep slopes and *Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* association on warmer, steep to somewhat steep slopes.

USGS-NPS Veg Data: 99S3 *(Pinus sabiniana/Ceanothus cuneatus*/grass Woodland); 98K8, 99K43, 99K8, 99S5 (*Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* Woodland); 99S16, 99K41 (*Pinus sabiniana-Quercus wislizeni*/*Arctostaphylos viscida* Woodland)
NRI data: 54, 55 (*Pinus sabiniana-Quercus wislizeni*/*Arctostaphylos viscida* Woodland)
(There are no samples for *Pinus sabiniana-Quercus wislizeni*/*Adenostoma fasciculatum* woodland which is a mapping unit at this time.)

---

***Pinus sabiniana - Quercus wislizeni/Ceanothus cuneatus* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Gray Pine - Interior Live Oak/Buckbrush Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |

| | |
|---|---|
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus sabiniana* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. This association is likely to occur elsewhere in the foothill belt of the Sierra Nevada.

**Yosemite and environs**

Stands of *Pinus sabiniana - Quercus wislizeni/Ceanothus cuneatus* woodland are found at low elevations within the mapping area of Yosemite and environs and were sampled within the El Portal and Kinsley 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus sabiniana - Quercus wislizeni/Ceanothus cuneatus* woodland are found at xeric sites at low elevations (1,400–2,200 feet) on the low to mid portions of south- to southwest- and sometimes northeast-facing, steep to somewhat steep slopes. Soils tend to be stony, moderately well developed with textures that range from sandy loam to clay loam. Parent materials include granite, diorite, slate, phyllite, igneous, and metamorphic rock. Soils are well drained to rapidly draining. Fire tends to be fairly common. Disturbance from exotics ranges from low to high.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus sabiniana, Quercus wislizeni* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus sabiniana, Quercus wislizeni* |
| Shrub | *Ceanothus cuneatus, Toxicodendron diversilobum* |
| Herbaceous | *Vulpia myuros, Bromus diandrus, Hypochaeris glabra, Avena barbata, Melica californica, Pentagramma triangularis* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus sabiniana - Quercus wislizeni/Ceanothus cuneatus* woodland consist of 5–70 percent cover at 0–0.5 meter tall, 5 percent cover at 0.5–1 meter tall, 20–30 percent cover at 1–2 meters tall, 5–10 percent cover at 2–5 meters tall, 5–40 percent cover at 5–10 meters tall, 10–60 percent cover at 10–15 meters tall, and 10–30 percent cover at 20–35 meters tall. This association has an intermittent tree layer dominated by *Pinus sabiniana* and *Quercus wislizeni* and an open understory shrub layer dominated by *Ceanothus cuneatus.* Also found in this association contributing to less cover are *Toxicodendron diversilobum, Vulpia myuros, Bromus diandrus, Hypochaeris glabra, Avena barbata, Melica californica,* and *Pentagramma triangularis.* Other species contributing to minor amounts of cover may include *Arctostaphylos viscida, Aira caryophyllea, Symphoricarpos mollis, Trifolium microcephalum, Pellaea mucronata, Bromus tectorum, Bromus arenarius,* and *Selaginella hansenii*. *Eriophyllum congdonii* is a rare species that may be found contributing to very little cover in this association.

OTHER NOTEWORTHY SPECIES
*Eriophyllum congdonii* is a List 1B species found in one of the four plots. This species occurs in Mariposa County and is usually found in chaparral, *cis*montane woodland, and lower montane coniferous forests on stony metamorphic sites at elevations of 1,600–6,200 feet. It is threatened by nonnative species (CNPS 2001).

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | This association was not defined from the statewide work of Allen et al. (1991), thus it is assumed that it is relatively restricted to the central Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
This type occurs relatively commonly on steep southerly exposures of the lower Merced River canyon.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K8, 99K43, 99K8, 99S5

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***Pinus sabiniana - Quercus wislizeni/Arctostaphylos viscida* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Gray Pine - Interior Live Oak/Whiteleaf Manzanita Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus sabiniana* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus sabiniana - Quercus wislizeni/Arctostaphylos viscida* woodland are sampled in the mapping area of Yosemite and environs within the Hetch Hetchy Reservoir, El Portal 7.5-minute, and Lake Eleanor 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus sabiniana - Quercus wislizeni/Arctostaphylos viscida* woodland are found at xeric sites at low elevations (1,800–4,500 feet) on the low to upper portions of southwest- to north-facing slopes at higher elevations. Slopes are linear, convex, and concave shaped and vary from gentle to steep. Soils tend to be poorly developed and stony in places with textures ranging from loamy sand to clay loam and of metamorphic and granitic parent materials. Litter ranges from 60–75 percent cover. Fire is common and can cover extensive areas. Impact from the invasion of exotic species can be high.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Arctostaphylos viscida* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus sabiniana, Quercus wislizeni* |
| Shrub | *Arctostaphylos viscida* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus sabiniana - Quercus wislizeni/Arctostaphylos viscida* woodland form an open to intermittent tree layer dominated by *Pinus sabiniana* and *Quercus wislizeni* with an intermittent understory shrub layer dominated by *Arctostaphylos viscida*. Other species contributing to minor cover varies and may include *Toxicodendron diversilobum, Aira caryophyllea, Bromus hordeaceus, Bromus diandrus, Cercis canadensis* var. *texensis, Eriodictyon californicum,* lichen, moss, *Rhamnus ilicifolia* (= *Rhamnus crocea* ssp. *ilicifolia), Rhus trilobata, Cheilanthes gracillima,* and *Ceanothus cuneatus. Ceanothus fresnensis* is a rare species that may occur within this association. The stands are usually relatively open but variable, and they may range from a woodland condition to a sparsely wooded herbaceous or shrubland condition as defined by the USNVC standards. Structurally, these stands consists of 20–60 percent cover at 5–10 meters tall, 20 percent cover at 2–5 meters tall, 20–40 percent cover at 1–2 meters tall, 10–20 percent cover at 0.5–1 meters tall, and 5–20 percent cover at 0–0.5 meters tall.

OTHER NOTEWORTHY SPECIES
*Ceanothus fresnensis* is a List 4 species found in one of the four plots. This species occurs in Calaveras, Fresno, Madera, Mariposa, Tulare, and Tuolumne counties and is usually found in *cis*montane woodland and lower montane coniferous forests at elevations of 2,900–6,500 feet (CNPS 2001).

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | This association was not defined from the statewide work of Allen et al., (1991), thus it is assumed that it is relatively restricted to the central Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
These stands are typically open on steep stony soils with poorer development than typically occurs with the associations that contain *Quercus douglasii*. It appears that *Quercus douglasii* requires deeper, perhaps more argillic, soil than *Quercus wislizeni*.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99S16, 99K41
NRI: 54, 55

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## *QUERCUS WISLIZENI* WOODLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Interior Live Oak Woodland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Extremely xeromorphic evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous extremely xeromorphic evergreen woodland |

The *Quercus wislizeni* alliance is known only from California. It occurs in the northern and central Coast Ranges, the foothills of the Klamath Mountains, Cascades and Sierra Nevada, and south through the montane Peninsular and Transverse ranges (NatureServe 2003). It grows on shallow, moderately, or excessively drained soils. Stands are found between 500 and 4500 m elevation (NatureServe 2003). The poor water-holding capacity of the soils and the extremely seasonal nature of precipitation where this alliance occurs create very droughty conditions through the long summer. Associated shrub species may include *Arctostaphylos viscida*, *Toxicodendron diversilobum*, and *Eriodictyon californicum*.

This alliance is represented locally by three associations, one of which was defined with data from this project. They are arranged along both moisture and temperature gradients from the warm and dry types of Allen et al. (1991)(*Quercus wislizeni-Arctostaphylos viscida* Woodland and *Quercus wislizeni-Quercus douglasii-Pinus sabiniana/Bromus* sp.-*Daucus pusillus* Association) to the more mesic *Quercus wislizeni-Quercus chrysolepis* Association.

USGS-NPS Veg Data: 99S8, 98M1 (*Quercus wislizeni-Quercus chrysolepis* Association); 99K24 (*Quercus wislizeni-Arctostaphylos viscida Woodland*); 99K1, 98K1 (*Quercus wislizeni-Quercus douglasii-Pinus sabiniana/Bromus* sp. *Daucus pusillus* Association)
Wieslander Data: 416 (*Quercus wislizeni-Arctostaphylos viscida Woodland*)
Potter Data: 1238 (*Quercus wislizeni-Quercus chrysolepis* Association)

***Quercus wislizeni* - *Quercus chrysolepis* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Interior Live Oak - Canyon Live Oak Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Extremely xeromorphic evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous extremely xeromorphic evergreen woodland |
| ALLIANCE | *Quercus wislizeni* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus wislizeni* - *Quercus chrysolepis* woodland are found at lower elevations on the west slope in mapping area of Yosemite and environs and were sampled within the Kinsley and El Portal 7.5-minute topographic quadrangles. It is seen in the more significant ravines north of the Merced River and also as stands in the Hetch Hetchy region where canyon live oak will tend to favor the lower, moister portions of canyons and draws.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus wislizeni* - *Quercus chrysolepis* woodland are found at dry mesic sites at low elevations (1,900–2,600 feet) on the low to mid portions of generally southwest-facing (at its lower elevation limits it can occur on drier north-facing aspects), moderately steep to steep slopes. Soils are poorly develop and tend to be well drained sandy loam and from metamorphic, igneous, and granitic parent materials. Invasion from exotic species is high at this association. Litter cover is 25–40 percent. Fire is uncommon in these stands.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni, Quercus chrysolepis* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni, Quercus chrysolepis* |
| Shrub | *Toxicodendron diversilobum* |
| Herbaceous | *Avena barbata, Pellaea andromedifolia, Vulpia myuros* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus wislizeni - Quercus chrysolepis* woodland form an open to intermittent tree layer dominated by *Quercus wislizeni* and *Quercus chrysolepis. Toxicodendron diversilobum* is usually present in the shrub layer. Found in the herb layer are *Avena barbata, Pellaea andromedifolia,* and *Vulpia myuros.* A variety of other species may contribute to minor cover and often include *Bromus diandrus, Trifolium microcephalum, Galium parisiense, Hypochaeris glabra, Claytonia perfoliata, Eschscholzia caespitosa, Pentagramma triangularis, Aesculus californica, Artemisia douglasiana, Bromus rubens, Bromus tectorum, Clarkia unguiculata,* and *Melica imperfecta. Eriophyllum congdonii* and *Carex tompkinsii* are rare species that may occur within this association. Stands of this type are found with approximately 5 percent cover at 20–30 meters tall, 40 percent cover at 10–15 meters tall, 5–10 percent cover at 2–5 meters tall, 5–10 percent cover at 1–2 meters tall, 40 percent cover at 0.5–1 meter tall, and 60 percent cover at 0–0.5 meter tall.

OTHER NOTEWORTHY SPECIES

*Eriophyllum congdonii* is a List 1B species found in one of the three plots. This species occurs in Mariposa County and is usually found in chaparral, *cis*montane woodland, and lower montane coniferous forests on stony metamorphic sites at elevations of 1,600–6,200 feet. It is threatened by nonnative species (CNPS 2001).

*Carex tompkinsii* is a List 4 species found at one of the three plots. It usually is found at chaparral, *cis*montane woodland, lower montane coniferous forests, and upper montane coniferous forest at 1,400–6,000 feet. This plant is found within Fresno, Mariposa, and Tuolumne counties (CNPS 2001).

| | |
|---|---|
| CONSERVATION RANK | G3 |
| RANK JUSTIFICATION | Relatively limited in acreage by topographic setting (ravine bottoms) and by narrow zone of overlap of the two characteristic tree species. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

Depending upon the delineation of the sampling plots, this association would be considered a riparian to semiriparian type. True riparian species such as *Calycanthus occidentalis* may be considered to occur in the stands if the central intermittent channels of the ravines are not excluded from the sample plots.

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99S8, 98M1
Potter: 1238

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***Quercus wislizeni - Arctostaphylos viscida Woodland* [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Interior Live Oak - Whiteleaf Manzanita Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |

| | |
|---|---|
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Natural/Seminatural |
| PHYSIOGNOMIC SUBGROUP | Extremely xeromorphic evergreen woodland |
| FORMATION | Sclerophyllous extremely xeromorphic evergreen woodland |
| ALLIANCE | *Quercus wislizeni* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is found in the Sierra Nevada and foothill regions from Yuba to Madera counties and in Shasta County (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus wislizeni - Arctostaphylos viscida* woodland are sampled in the mapping area of Yosemite and environs within the Cherry Lake South 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Quercus wislizeni - Arctostaphylos viscida* woodland are found at low elevations (600–4,250 feet) on all aspects of slopes that are primarily less than 45 percent. Soil textures range from gravelly sands to clayey loams from granitic, metamorphic and some sedimentary parent materials (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus wislizeni - Arctostaphylos viscida* woodland are found at low elevations (3,400–3,800 feet) on steep, south- to southwest-facing slopes. Soils are moderately deep, poorly drained to rapidly drained, with textures ranging from stony loam to loamy sand of granitic material.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus wislizeni* |
| Shrub | *Arctostaphylos viscida, Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni* |
| Shrub | *Arctostaphylos viscida, Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus wislizeni, Pinus sabiniana* |
| Shrub | *Arctostaphylos viscida, Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni* |
| Shrub | *Arctostaphylos viscida* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Quercus wislizeni - Arctostaphylos viscida* woodland are dominated by *Quercus wislizeni, Arctostaphylos viscida*, and *Ceanothus cuneatus* with an understory of grasses. *Quercus kelloggii* and *Quercus douglasii* may also

be found in this association but are of low cover. Shrubs that may be found here include *Heteromeles arbutifolia, Toxicodendron diversilobum,* and *Rhamnus crocea.* Rarely occurring are *Aesculus californica, Calocedrus decurrens, Pinus ponderosa, Pseudotsuga menziesii, Quercus chrysolepis, Quercus lobata, Quercus durata, Quercus x morehus, Corylus cornuta, Fremontodendron californicum (= Fremontia californica), Pinus sabiniana, Adenostoma fasciculatum, Arctostaphylos manzanita, Arctostaphylos viscida* ssp. *mariposa (= Arctostaphylos mariposa), Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), *Ceanothus integerrimus, Chamaebatia foliolosa, Diplacus aurantiacus (= Mimulus aurantiacus), Eriodictyon californicum, Garrya veatchii, Lonicera subspicata, Prunus subcordata, Frangula californica (= Rhamnus californica), Rhus trilobata, Ribes californicum, Ribes roezlii, Rosa californica, Sambucus caerulea, Symphoricarpos albus* var. *laevigatus (= Symphoricarpos rivularis), Apocynum cannabinum, Triteleia laxa (= Brodiaea laxa), Erodium cicutarium, Ericameria arborescens (= Haplopappus arborescens),* and *Lupinus albifrons.* Most of the tree species in this association have a dbh between 4–11 inches, and some of the tree species have a dbh of 12–23 inches (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus wislizeni - Arctostaphylos viscida* woodland are dominated by *Quercus wislizeni* in the tree and shrub layers and *Arctostaphylos viscida* in the shrub layer with an understory of herbs and grasses. *Quercus chrysolepis, Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), *Ceanothus cuneatus, Adenostoma fasciculatum,* and *Toxicodendron diversilobum* can be common at these sites. Other species present may include *Bromus diandrus, Bromus laevipes, Eriophyllum lanatum, Galium bolanderi, Lupinus albifrons, Lupinus benthamii, Pellaea mucronata, Phacelia mutabilis, Pinus sabiniana, Poa secunda, Pseudognaphalium canescens, Rhamnus ilicifolia (= Rhamnus crocea* ssp. *ilicifolia), Symphoricarpos mollis,* and *Umbellularia californica.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Stands apparently occur throughout the foothill zones of California north of the Transverse Ranges. However, stand quality in many areas may be compromised by invasive exotics and development.

DATABASE CODE To be determined

COMMENTS
**Globally**
There is good correspondence between the vegetation description by Allen of *Q. wislezeni-Q. douglasii-P. sabiniana* woodland association throughout its range and the subset of species found locally in the Yosemite mapping area. Overstory species are the same though the cover is lower at Yosemite for *Quercus douglasii* and *Pinus sabiniana*. Yosemite has *Toxicodendron* as one of the understory species; globally, poison oak may occur along with *Ceanothus cuneatus, Ribes,* or *Arctostaphylos* sp.

**Yosemite and environs**
Currently there is an uncertain relationship between this association and *Pinus sabiniana - Quercus wislizeni/ Arctostaphylos viscida* woodland. In general, the only substantive distinction is that this association has usually less than 10 percent *Pinus sabiniana*. Definitions become problematic at the low levels of total vegetation cover where total tree cover is less than 20 percent. To separate the *Pinus sabiniana* from the *Quercus wislizeni* alliance, the current definition requires that a stand must have greater than 60 percent relative cover of the nominal species in the tree layer to be a member of that alliance.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99K24
Wieslander: **416**

***Quercus wislizeni - Quercus douglasii - Pinus sabiniana*/Bromus sp-Daucus pusillus Woodland**

| | |
|---|---|
| **COMMON NAME** | **Interior Live Oak - Blue Oak - Gray Pine Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Natural/Seminatural |
| PHYSIOGNOMIC SUBGROUP | Extremely xeromorphic evergreen woodland |
| FORMATION | Sclerophyllous extremely xeromorphic evergreen woodland |
| ALLIANCE | *Quercus wislizeni* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association occurs in the Sierra Nevada from Butte County to Kern County and in San Benito County (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus wislizeni - Quercus douglasii - Pinus sabiniana* woodland are sampled in the mapping area of Yosemite and environs within the El Portal 7.5 minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Quercus wislizeni - Quercus douglasii - Pinus sabiniana* woodland are found at low elevations (400–5,000 feet) on north- to northeast- and south- to southwest-facing slopes that are primarily less than 25 percent. Soil textures are loam to stony clay loam and sand loams. Parent materials are mostly granitic or mixed and occasionally mafic or metamorphic (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus wislizeni - Quercus douglasii - Pinus sabiniana* woodland are found at low elevations (1,600–2,200 feet) on the low to mid portion of south- to southwest-facing steep slopes. Soils are poorly drained to well drained with textures ranging from silt loam to clay loam. Parent materials are metamorphic and schist. Disturbance from invasion of exotics is common with impact levels of low to high. Vandalism, dumping, and litter may also have a low impact.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus wislizeni, Quercus douglasii, Pinus sabiniana* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni* |
| Herbaceous | *Poaceae, Hypochaeris glabra* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus wislizeni, Quercus douglasii, Pinus sabiniana* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus wislizeni, Quercus douglasii, Pinus sabiniana* |
| Shrub | *Toxicodendron diversilobum* |

| | |
|---|---|
| Herbaceous | *Poaceae, Hypochaeris glabra, Galium parisiense, Daucus pusillus, Clarkia purpurea, Torilis arvensis, Castilleja densiflora* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Quercus wislizeni - Quercus douglasii - Pinus sabiniana* woodland are dominated by *Quercus wislizeni*, *Quercus douglasii*, and *Pinus sabiniana* with an understory of grasses. Shrubs that may be found here include *Ceanothus cuneatus, Toxicodendron diversilobum, Ribes californicum*, and *Arctostaphylos viscida*. Rarely occurring are *Aesculus californica, Quercus chrysolepis, Quercus kelloggii, Quercus garryana, Pinus jeffreyi, Amelanchier utahensis, Arctostaphylos manzanita, Arctostaphylos viscida* ssp. *mariposa (= Arctostaphylos mariposa), Artemisia tridentata, Ceanothus leucodermis, Ceanothus spinosus, Eriodictyon californicum, Eriogonum fasciculatum, Ericameria linearifolia (= Haplopappus linearifolius), Heteromeles arbutifolia, Juniperus californica, Lonicera subspicata, Prunus ilicifolia, Prunus virginiana, Frangula californica (= Rhamnus californica), Rhamnus crocea, Ribes*, sp. and *Salix* sp. Most of the tree species in this association have a dbh between 4–11 inches, and some of the tree species have a dbh of 12–23 inches (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus wislizeni - Quercus douglasii - Pinus sabiniana* woodland consist of 0–70 percent cover at 0–0.5 meter tall, 5 percent cover at 0.5–1 meter tall, 5–40 percent cover at 1–2 meters tall, 0–20 percent cover at 2–5 meters tall, 20 percent cover at 5–10 meters tall, 5–40 percent cover at 10–15 meters tall, and 5 percent cover at 20–35 meters tall. This association is dominated by *Quercus wislizeni* in the overstory. *Pinus sabiniana* and *Quercus douglasii* are less abundant but also important in the overstory. *Hypochaeris glabra, Galium parisiense, Daucus pusillus*, and a variety of grasses and herbs are found in the understory. Understory species often found at this association include *Bromus diandrus, Clarkia purpurea, Torilis arvensis, Toxicodendron diversilobum*, and *Castilleja densiflora*. Occasionally, *Bromus hordeaceus, Triteleia ixioides, Avena fatua*, and *Lupinus benthamii* are common. *Bromus arenarius, Cercis canadensis* var. *texensis, Ceanothus cuneatus, Medicago polymorpha, Poa secunda, Rhamnus ilicifolia (= Rhamnus crocea* ssp. *ilicifolia), Sanicula bipinnatifida*, and *Vulpia myuros* are occasionally found contributing minor cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | Likely to occur throughout much of the foothill belt of *cis*montane California, but threatened to some degree by invasive exotics, development, and by higher than modal grazing pressure. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

**Plots used to describe association locally (n=2)**

USGS–NPS Veg Data: 99K1, 98K1

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***Quercus douglasii/Ceanothus cuneatus/Poaceae* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Blue Oak/Buckbrush/Grass Species Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |

| | |
|---|---|
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |
| ALLIANCE | *Quercus douglasii* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association occurs in the foothills and Sierra Nevada from Butte to Fresno counties, and in the Central Coast in Monterey and San Benito counties (Allen et al., 1991)

**Yosemite and environs**

Stands of *Quercus douglasii/Ceanothus cuneatus/Poaceae* forest are sampled in the mapping area of Yosemite and environs specifically within the El Portal 7.5 minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Quercus douglasii/Ceanothus cuneatus/Poaceae* forest are found at low elevations (300–3,800 feet) on all aspects of slopes that are moderately steep to very steep (25–63%). Soils are stony and gravelly sandy loams from granitic soils (basalts and shales) (Allen et al., 1991).

**Yosemite and environs**

The single plot sampled in this association locally is at 2,311 feet elevation on a steep, south-facing, midslope aspect with loamy soil derived from granitic rock.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus douglasii, Pinus sabiniana* |
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii* |
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | Quercus *douglasii, Pinus sabiniana, Quercus wislizeni* |
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii* |
| Shrub | *Ceanothus cuneatus* |
| Herbaceous | *Poaceae* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Quercus douglasii/Ceanothus cuneatus/Poaceae* forest are dominated by *Quercus douglasii* in the overstory, *Ceanothus cuneatus* in the understory shrub layer, and species of *Poaceae* in the understory herbaceous layer. *Pinus sabiniana* and *Quercus wislizeni* are usually found in this association. *Aesculus californica* is

occasionally present. Other species present may include *Rhus crocea, Toxicodendron diversilobum,* and *Arctostaphylos viscida* (Allen et al., 1991).

**Yosemite and environs**
The tree cover is 20 percent, shrub cover 20 percent, and herbaceous cover 70 percent in one plot sampled locally. *Quercus douglasii* is 15 percent and *Quercus wislizeni* is 2.5 percent as the main tree species, while *Ceanothus cuneatus* covers 15 percent of the shrub layer. The dominant herb species include *Hypochaeris glabra* (15%), *Bromus tectorum* (15%), and *Daucus pusillus* (2.5%).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION Likely to occur throughout much of the foothill belt of *cis*montane California but threatened to some degree by invasive exotics, development, and by higher than modal grazing pressure.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=1)**
USGS–NPS Veg Data: 99S35

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***Quercus douglasii - Pinus sabiniana/Poaceae* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Blue Oak - Gray Pine - Grass Species Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |
| ALLIANCE | *Quercus douglasii* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found in the foothills and Sierra regions from Placer to Fresno counties and in the central coast area from Monterey to Los Angeles counties (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus douglasii - Pinus sabiniana/Poaceae* woodland are sampled in the mapping area of Yosemite and environs within the El Portal 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**

Stands of *Quercus douglasii - Pinus sabiniana/Poaceae* woodland are found at low elevations (300–4,000 feet) on all aspects, primarily on slopes of less than 35 percent but were occasionally found on flat areas. Soil textures range from gravel to clay loam from various parent materials (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus douglasii - Pinus sabiniana/Poaceae* woodland are found at low elevations (1,700–2,600 feet) on the mid portions of southeast- to southwest-facing steep slopes. Soils are well drained to rapidly drained with textures of mostly clay loam of metamorphic parent material. Bedrock contributes 0–1 percent cover, large rocks contribute 2–3 percent cover, and small rocks contribute 5–20 percent cover. Litter contributes 45–88 percent cover, wood contributes 2–4 percent cover, and bare ground is 1–29 percent cover.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Quercus douglasii, Pinus sabiniana* |
| Herbaceous | *Poaceae* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii, Quercus wislizeni* |
| Herbaceous | *Poaceae* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii, Pinus sabiniana, Quercus wislizeni* |
| Herbaceous | *Poaceae* |

VEGETATION DESCRIPTION
**Globally**
Stands of *Quercus douglasii - Pinus sabiniana/Poaceae* woodland are dominated by *Quercus douglasii* and *Pinus sabiniana* with an understory of grasses. Shrubs that may be found here may include *Lonicera subspicata, Ceanothus cuneatus,* and *Rhamnus crocea.* Rarely occurring are *Aesculus californica, Quercus agrifolia, Quercus lobata, Quercus wislizeni, Quercus durata, Umbellularia californica, Adenostoma fasciculatum, Artemisia californica, Arctostaphylos glauca, Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), *Ceanothus leucodermis, Ceanothus sorediatus, Corylus cornuta, Eriodictyon californicum, Eriodictyon crassifolium, Eriogonum fasciculatum, Fraxinus dipetala, Ericameria linearifolia (= Haplopappus linearifolius), Hazardia squarrosa, Frangula californica (= Rhamnus californica), Toxicodendron diversilobum, Rhus trilobata, Ribes californicum,* and *Sambucus caerulea.* Most of the tree species in this association have a dbh between 4-11 inches, and some of the tree species have a dbh of 12-23 inches (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus douglasii - Pinus sabiniana/Poaceae* woodland consist of 0–70 percent cover at 0–0.5 meter tall, 5–70 percent cover at 0.5–1 meter tall, 5 percent cover at 1–2 meters tall, 5 percent cover at 2–5 meters tall, 20 percent cover at 5–10 meters tall, 40 percent cover at 10–15 meters tall, and 60 percent cover at 15–20 meters tall. This association forms an open to continuous tree layer dominated by *Quercus douglasii* and *Pinus sabiniana* with an understory of grasses. *Quercus wislizeni* is also common in the tree layer. A variety of other species may be present, but *Avena barbata, Bromus arenarius, Bromus hordeaceus, Hypochaeris glabra, Lactuca serriola,* and *Trifolium microcephalum* are the most common species found in the understory. Others include *Bromus diandrus, Daucus pusillus, Lessingia leptoclada, Toxicodendron diversilobum,* and *Galium parisiense.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

| | |
|---|---|
| RANK JUSTIFICATION | Likely to occur throughout much of the foothill belt of *cis*montane California but threatened to some degree by invasive exotics, development, and by higher than modal grazing pressure. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
This association occurs in both the lower Tuolumne and Merced river canyons in the study area. It is usually associated with relatively well developed clay soils on slopes and transitions abruptly to *Pinus sabiniana* - *Quercus wislizeni* or chaparral types on less argillic soils.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99K18, 99K2

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***Quercus douglasii/Bromus* spp. - *Daucus pusillus* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Blue Oak/Brome Species - American Wild Carrot Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |
| ALLIANCE | *Quercus douglasii* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association is included within the broader description by Allen et al., (1991) called *Quercus douglasii*/grass. As described by them, the *Quercus douglasii/*grass association ranges from Shasta County to Tulare County and south in the coast ranges to San Luis Obispo County.

**Yosemite and environs**
Stands of *Quercus douglasii/Bromus* spp.- *Daucus pusillus* woodland are found in the lowest elevations of the mapping area and were sampled within the El Portal and Cherry Lake South 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus douglasii/Bromus* spp. - *Daucus pusillus* woodland are found at xeric to dry mesic environments at low elevations (2,300–3,800 feet) on the mid to high portions of southeast- to northwest-facing slopes that are variable in steepness (gentle to steep). Slopes tend to be linear to undulating. Soils are moderately well developed with textures ranging from sandy loam to clay loam from metamorphic parent material. The soils at these sites tend to be somewhat poorly drained to well drained. Fire in this association is common but usually is not extensive. Litter cover ranges from 45–95 percent but tends to be 80–90 percent. Invasion from exotic species is common at this association with impact levels of low to high.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the Yosemite Park. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii* |
| Herbaceous | *Avena barbata* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii* |
| Herbaceous | *Bromus* spp., *Daucus pusillus, Avena barbata, Galium parisiense, Lactuca serriola* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Quercus douglasii/Bromus* spp. - *Daucus pusillus* woodland form an open to intermittent tree layer dominated by *Quercus douglasii.* The understory is continuous with predominantly *Bromus* spp. *(Bromus hordeaceus, Bromus arenarius,* and *Bromus diandrus*), *Daucus pusillus, Avena barbata, Galium parisiense, Lactuca serriola,* and a large variety of other herbs and grasses. Often common is *Hypochaeris glabra. Trifolium microcephalum* and *Trifolium wormskioldii* are sometimes common. *Daucus pusillus, Castilleja densiflora, Silene gallica, Torilis arvensis, Brodiaea elegans, Vulpia myuros, Pinus sabiniana, Clarkia purpurea, Gilia capitata, Trifolium ciliolatum, Erodium cicutarium, Lupinus bicolor, Pellaea mucronata,* and *Quercus wislizeni* are often present contributing to minor cover. *Perideridia bacigalupii* is a rare species that may be contributing to minor cover in this association. Stands consists of 80–90 percent cover at 0–0.5 meter tall, 5–90 percent cover at 0.5–1 meter tall, 0–20 percent cover at 1–2 meters tall, 5 percent cover at 2–5 meters tall, 5–50 percent cover at 5–10 meters tall, 20–40 percent cover at 10–15 meters tall, and occasionally 20 percent cover at 20–35 meters tall.

OTHER NOTEWORTHY SPECIES

*Perideridia bacigalupii* is a List 4 species (CNPS 2001) found at one of the five plots. It usually is found at chaparral, lower montane coniferous forests/serpentinite at elevations of 1,500–3,300 feet. This plant is found within Amador, Butte, Calaveras, Madera, Mariposa, Nevada, Tuolumne, and Yuba counties.

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | Likely to occur throughout much of the foothill belt of *cis*montane California but threatened to some degree by invasive exotics, development, and by higher than modal grazing pressure. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99S20, 98K10, 98K15, 98K22, 99K16

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***Quercus douglasii - Quercus wislizeni/Bromus* spp. - *Daucus pusillus* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Blue Oak - Interior Live Oak/Brome Species - American Wild Carrot Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Deciduous woodland |
| PHYSIOGNOMIC GROUP | Cold deciduous woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Cold deciduous woodland |
| ALLIANCE | *Quercus douglasii* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found primarily in the foothills of the Sierra Nevada to Mariposa County (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus douglasii* - *Quercus wislizeni/Bromus* spp. - *Daucus pusillus* woodland are sampled in the mapping area of Yosemite and environs within the El Portal 7.5 minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION
**Globally**
Stands of *Quercus douglasii* - *Quercus wislizeni/Bromus* spp. - *Daucus pusillus* woodland are found at low elevations (200–3,800 feet) on all aspects of slopes that are primarily less than 45 percent. Soil textures vary and are of granitic, metamorphic, and some sedimentary parent materials (Allen et al., 1991).

**Yosemite and environs**
Stands of *Quercus douglasii* - *Quercus wislizeni/Bromus* spp. - *Daucus pusillus* woodland are found at low elevations (1,700–2,100 feet) on the low to high portions of slopes of all aspects that are somewhat steep to steep. Soils are well drained to rapidly drained with textures ranging from sandy loam to clay loam from granitic, metamorphic, and some sedimentary parent materials. Soils are well drained to rapidly drained.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Quercus douglasii, Quercus wislizeni* |
| Herbaceous | *Bromus* spp., *Daucus pusillus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii, Quercus wislizeni* |

| | |
|---|---|
| Herbaceous | *Bromus* spp., *Daucus pusillus* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Quercus douglasii, Quercus wislizeni* |
| Herbaceous | *Bromus* spp., *Daucus pusillus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Quercus douglasii, Quercus wislizeni* |
| Herbaceous | *Bromus* spp. *(Bromus madritensis, Bromus arenarius, Bromus diandrus, Bromus hordeaceus), Daucus pusillus, Torilis arvensis, Lactuca serriola* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Quercus douglasii - Quercus wislizeni/Bromus* spp. - *Daucus pusillus* woodland are dominated by *Quercus douglasii* and *Quercus wislizeni* with an understory of grasses that are mainly composed of *Bromus* sp. and *Daucus pusillus*. *Pinus sabiniana* may also be found occurring in this association. Shrubs that may be found here include *Ceanothus cuneatus, Toxicodendron diversilobum, Arctostaphylos* sp., *Heteromeles arbutifolia,* and *Rhamnus crocea*. Rarely occurring are *Aesculus californica, Pinus ponderosa, Quercus chrysolepis, Quercus kelloggii, Quercus lobata, Acer macrophyllum, Pseudotsuga menziesii, Adenostoma fasciculatum, Artemisia californica, Arctostaphylos viscida, Cercocarpus montanus* var. *glaber (= Cercocarpus betuloides* var. *betuloides*), *Ceanothus leucodermis, Diplacus aurantiacus (= Mimulus aurantiacus), Eriodictyon californicum, Frangula californica (= Rhamnus californica), Rhus trilobata, Ribes* sp., *Ribes californicum, Sambucus caerulea, Xylococcus bicolor, Corethrogyne californica,* and *Ericameria arborescens (= Haplopappus arborescens).* Most of the tree species in this association have a dbh between 4–11 inches (Allen et al., 1991).

**Yosemite and environs**

Stands of *Quercus douglasii - Quercus wislizeni/Bromus* spp. - *Daucus pusillus* woodland are dominated by *Quercus douglasii* and *Quercus wislizeni* with an understory of herbaceous species that are mainly composed of *Bromus* sp. *(Bromus madritensis, Bromus arenarius, Bromus diandrus, Bromus hordeaceus),* and *Daucus pusillus*. *Torilis arvensis* and *Lactuca serriola* are found contributing minor cover. A large variety of understory species are present and often include *Hypochaeris glabra, Toxicodendron diversilobum, Lessingia leptoclada, Avena barbata, Anaphalis margaritacea, Melica californica, Trifolium microcephalum, Centaurea melitensis,* and *Galium parisiense. Clarkia purpurea* is sometimes common in this association. Other species contributing to minor cover may include *Claytonia perfoliata, Galium aparine, Galium nuttallii, Lithophragma bolanderi, Medicago polymorpha, Pentagramma triangularis, Pinus sabiniana,* and *Yabea microcarpa*. The structure of the association consists of 5–70 percent cover at 0–0.5 meter tall, 5–20 percent cover at 0.5–1 meter tall, 5 percent cover at 1–2 meters tall, 5–20 percent cover at 2–5 meters tall, 5 percent cover at 5–10 meters tall, 20–40 percent cover at 10–15 meters tall, and 5–60 percent cover at 15–20 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably fairly common in the northern and the central Sierra Nevada foothills.

DATABASE CODE To be determined

COMMENTS

**Globally**

Information was obtained from Allen et al., (1991) for the Interior Live Oak-Blue Oak/Grass association.

**Yosemite and environs**

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 99S12, 99S13, 99S15, 99S34, 99K3, 98M12

ECOLOGICAL ZONE III: FORESTS, SCRUBS, AND MEADOWS OF THE MIDELEVATION WEST SLOPE

HERBACEOUS VEGETATION

***Lupinus latifolius* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Broadleaf Lupine Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |
| ALLIANCE | *Lupinus latifolius* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is described only from the vicinity of Yosemite. Information about its global range is not available without additional inventory. However, *Lupinus latifolius* is found throughout the mountainous regions of the western United States (USDA NRCS PLANTS database 2001) and is likely to form other stands in California and other states. Similar stands have been observed in the Klamath Mountains and the north coast ranges of California (Keeler–Wolf pers. obs.). Don Potter (pers com 2002) has sampled 14 plots that he characterized as *Lupinus latifolius* plots throughout the central and southern Sierra Nevada.

**Yosemite and environs**
This association has been documented from stands in the Ackerson Meadow and Tenaya Lake 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this forb association occur in wet to moist meadow environments including small stream channels and seeps. Sites are mesic to temporarily saturated meadows. Elevations range from about 6,200–8,200 feet, and slopes are flat, gentle, or moderate and, when having an aspect, face southeast to west. Soils are somewhat poorly drained loam to moderately well drained sandy loam.

MOST ABUNDANT SPECIES
**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Lupinus latifolius, Heracleum maximum*
CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Lupinus latifolius, Heracleum maximum*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This perennial forb vegetation is characterized by dense cover (from 60–90%) of moisture-loving forbs and grasses, primarily *Lupinus latifolius.* Total vegetative cover is generally greater than 80 percent. *Lupinus latifolius* (10–67% cover) is the most common forb. Other forbs of greater than 50 percent constancy include *Heracleum maximum* (10–30 percent), *Allium validum* (5% cover), *Thalictrum fendleri* (2%), *Trifolium monanthum* (2.5%), *Poa pratensis* (1%), *Danthonia intermedia* (1%), *Carex leptopoda* (5%), and *Poa fendleriana* (1%). The forbs and graminoids present in trace amounts include an additional 30 species.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread, but no information.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Locally these stands are relatively small and occur in meadows surrounded by white fir - sugar pine, California red fir - white fir, and California red fir alliances. There is some uncertainty about the classification of this association. It may be more properly placed in the *Heracleum maximum* alliance (currently described from Montana and Wyoming in NatureServe). Halpern (1986) has described an *Elymus glaucus - Heracleum maximum* association from Sequoia National Park that bears some resemblance to the local association. Another confusion is that *Lupinus polyphyllus* and *Lupinus latifolius* are similar and either one or the other may dominate these sites. In general *Lupinus polyphyllus* is more of a hydrophyte.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K61, 99K136, 98K125
NRI: 114

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***Solidago canadensis - Achillea millefolium* Herbaceous Vegetation [Provisional]**

**COMMON NAME** **Canada Goldenrod - Common Yarrow Herbaceous Vegetation**
**SYNONYM** **None**

| | |
|---|---|
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |
| ALLIANCE | *Solidago canadensis* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. However, *Solidago canadensis* is found in every state in the union (USDA NRCS PLANTS database 2001) and is likely to form other stands in California and other states.

**Yosemite and environs**

This association has been documented from stands in Ackerson Mountain, Half Dome, Wawona, and White Chief Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this forb association occur in dry to moist meadow environments. Sites are mesic to temporarily saturated meadows. Elevations range from about 5,620–7,000 feet, and slopes are flat, gentle, or moderate and, when having an aspect, face southeast to west. Soils are somewhat poorly drained loam to silty loam.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Solidago canadensis*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Solidago canadensis, Achillea millefolium*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This perennial forb vegetation is characterized by dense cover of moisture-loving forbs and grasses, primarily *Solidago canadensis.* Total vegetative cover is generally greater than 80 percent. *Solidago canadensis* (35–67%

cover) is the most common forb. Other forbs of greater than 50 percent constancy include *Achillea millefolium* (5% cover), *Horkelia fusca* (5%), *Agrostis scabra* (2.5%), *Mimulus primuloides* (2%), *Poa pratensis* (1%), *Potentilla gracilis* (1%), and *Deschampsia caespitosa* (1%). The forbs and graminoids present in trace amounts include an additional 30 species.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread, but no information

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

Locally these stands are relatively small and occur in meadows surrounded by white fir - sugar pine, California red fir - white fir, and California red fir alliances.

**Plots used to describe association (n=4)**

USGS–NPS Veg Data: 99K104, 99S121, 98M61
NRI: 284

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***Veratrum californicum - Senecio triangularis* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **California False Hellebore - Arrowleaf Ragwort Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded temperate perennial forb vegetation |
| ALLIANCE | *Veratrum californicum* Temporarily Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association has been described from Yosemite and environs and the Lake Tahoe region of California, Oregon, and western Nevada (Manning and Padgett, 1991). Information about its global characteristics is not available without additional inventory. Don Potter (pers com 2002) has sampled 38 plots that he considers this association throughout the central and southern Sierra Nevada but has not described them formally.

**Yosemite and environs**

This association is widespread but localized in meadows and riparian settings in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association occurs between 7,400–10,000 feet in elevation on gentle to moderate slopes and is often found along streams. Aspects are commonly northern and eastern. Soil parent materials are varied. Soil textures range from silt loams to muck and are moderately well drained to poorly drained. Sites are palustrine, ranging from seasonally saturated to intermittently flooded.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Veratrum californicum*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Veratrum californicum, Senecio triangularis*

VEGETATION DESCRIPTION
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association is characterized by a high cover of herbaceous meadow species with no tree cover. Shrub cover is open including *Salix lasiolepis* and *Cornus sericea* ssp. *sericea,* although more commonly there are no shrubs. *Veratrum californicum, Lupinus latifolius, Senecio triangularis, Epilobium ciliatum,* and *Glyceria striata (= Glyceria elata)* are the most frequent herbaceous species, while *Senecio triangularis, Veratrum californicum, Lupinus latifolius,* and *Allium validum* have the highest cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4S3

RANK JUSTIFICATION Restricted to moist meadows in Oregon, California, and western Nevada; probably some threats by grazing outside of protected areas.

DATABASE CODE CEGL001989

COMMENTS
**Globally**
This association has been considered part of the *Senecio triangularis* alliance by Manning and Padgett (1991). Their description suggests that *Senecio triangularis* is the dominant species. However, locally *Veratrum* is dominant. Regardless of which alliance it is placed in, this is most likely a single association.

**Yosemite and environs**

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K66, 98M105, 98K95
Potter: 1511

*Glyceria striata* (*Glyceria elata*, Hickman 1993) Herbaceous Vegetation [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Fowl Manna Grass Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded temperate or subpolar grassland |
| ALLIANCE | *Glyceria striata* Temporarily Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association has been defined within Sequoia National Park (Halpern, 1986).

**Yosemite and environs**
Stands of *Glyceria striata* (=*Glyceria elata*) herbaceous vegetation were sampled within the Koip Peak, Ackerson Mountain, and Mammoth Lake 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is common along meadow edges on elevated flats in the driest portions of montane meadows in broad, open basins of the mixed conifer forest zone of Sequoia National Park (Halpern, 1986).

**Yosemite and environs**
Stands of *Glyceria striata* (=*Glyceria elata*) herbaceous vegetation are found at mid to high elevations (6,000–10,500 feet) on flat to moderate slopes. This association is found at basin floors and in seeps from low to upper portions of slopes. It is found at moist sites such as margins of lake beds, meadows, channel beds, and drainages that are seasonally flooded to saturated or permanently flooded. Soils are usually moist with textures that range from sand to muck on a granitic substrate. Drainage is poor to rapid. Litter cover is often high (10–85 percent cover), and bare soil varies but is high (10–70 percent). Disturbance levels are usually low.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Glyceria striata* (=*Glyceria elata*)(Halpern, 1986)

**Yosemite and environs**
Herbaceous *Glyceria striata* (=*Glyceria elata*)

CHARACTERISTIC SPECIES
**Globally**
Herbaceous *Glyceria striata* (=*Glyceria elata*) (Halpern, 1986)

**Yosemite and environs**
Herbaceous *Glyceria striata* (=*Glyceria elata*)

VEGETATION DESCRIPTION
**Globally**

Only *Glyceria striata* (=*Glyceria elata*) reaches high cover (> 30%) in Sequoia National Park. Species of greatest constancy and cover (in Sequoia National Park) include *Lotus oblongifolius, Senecio clarkianus, Castilleja miniata, Solidago canadensis*, and *Glyceria elata*. Species of Cyperaceae occur occasionally but are more common on wetter sites. Additional species commonly occurring (> 75% constancy) are *Veratrum californicum, Elymus glaucus* ssp. *jepsonii, Oxypolis occidentalis, Sidalcea ranunculacea, Stachys albens, Senecio triangularis, Viola glabella*, and *Habenaria dilatata* (Halpern, 1986).

**Yosemite and environs**
Stands of *Glyceria striata* (=*Glyceria elata*) herbaceous vegetation form a continuous herbaceous layer of predominantly *Glyceria striata (= Glyceria elata). Senecio triangularis, Perideridia parishii, Polygonum bistortoides*, and *Veratrum californicum* are often found in this association. *Mimulus guttatus, Aconitum columbianum, Carex nervina*, and *Calamagrostis canadensis* are common in some stands. A large variety of other herbaceous species are present such as *Lotus oblongifolius, Mimulus primuloides, Senecio scorzonella, Agrostis exarata, Agrostis oregonensis, Galium triflorum, Juncus chlorocephalus, Lilium parvum, Lupinus burkei* ssp. *burkei, Lupinus latifolius, Muhlenbergia filiformis, Rudbeckia californica, Stachys albens, Equisetum arvense, Isoetes bolanderi (*= var. *pygmaea), Oxypolis occidentalis*, and *Sidalcea reptans.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3

RANK JUSTIFICATION Likely to be of limited extent in California and western North American mountains.

DATABASE CODE To be determined

COMMENTS
**Global**
Potter's plots (Don Potter pers com 2002) often go to types dominated by these species: *Senecio tringularis, Polygonum bistortoides, Veratrum californicum.* Clearly, ecological similarities exist between these types and should be resolved with further sampling and analysis.

**Yosemite and environs**
Stands are generally small and restricted to wet meadows and saturated streamsides in openings in California red fir forest alliance.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 99K137, 99S137, 98K102, 98K122, 99K163, 99K127

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***JUNCUS NEVADENSIS* HERBACEOUS ALLIANCE** (Potter, 2000 Ms)

| | |
|---|---|
| **COMMON NAME** | **Nevada rush Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate or subpolar grassland |

This association is represented locally by one undescribed association. The *Juncus nevadensis* Alliance is usually found in wet meadows between 3,000 and 7,000 ft. elevation. Information on this type is not well developed but this is a putative type based on more wide ranging sampling by Potter (2000 ms). Further sampling is required. One association-level sample was collected.

USGS-NPS Veg Data: 98K39 (*Juncus nevadensis-Carex leporinella* Herbaceous Vegetation)

***Poa pratensis* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Kentucky Bluegrass Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded temperate or subpolar grassland |
| ALLIANCE | *Poa pratensis* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association has been defined from central and southern Sierra Nevada. Don Potter has sampled 32 stands throughout central and southern Sierra Nevada (pers com. 2002).

**Yosemite and environs**
Stands of *Poa pratensis* herbaceous vegetation are sampled in the mapping area of Yosemite and environs within the El Capitan, Ackerson Mountain, and Mammoth Lake 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
Potter (2000) has sampled 32 stands of this vegetation in central and southern Sierra Nevada. Elevations range mostly from 4,900–8,500 feet generally in the montane but below the subalpine zone. Stands occupy mesic meadows where slopes average 4 percent and range from 0.5–8 percent. Sites are often on elevated portions of meadows at the bottom of wide valleys. Meadows are forested at their edges. Most meadows contain first and second order streams less than 5 meters wide. Surface topography is concave to undulating. Seasonal flooding from upstream sources is typical, and sites may be covered with standing water during runoff. Sites typically go drier by the end of summer. Compared to other meadow sites, these are generally mesic to very dry stands.

**Yosemite and environs**
Stands of *Poa pratensis* herbaceous vegetation are found at midelevations (3,900–6,500 feet) on flat to moderate slopes. This association is found at basin floors and low to upper portions of slopes. It is found at moist sites such as meadows and drainages that are seasonally flooded to saturated. Soils are usually moist with textures that are clay loam on a granitic substrate. Drainage is poor to moderate. Litter cover is variable but often high (10–85% cover), and bare soil varies (10–70%). Disturbance levels are usually low currently, but belie a site history that involves grazing and pasturing in many cases.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Poa pratensis, Carex integra, Achillea millefolium*

**Yosemite and environs**
Herbaceous *Poa pratensis*

CHARACTERISTIC SPECIES
**Globally**
Herbaceous *Poa pratensis*

**Yosemite and environs**
Herbaceous *Poa pratensis*

VEGETATION DESCRIPTION
**Globally**
Stands are dense (ca. 100% cover) with forbs and graminoids both contributing about equal cover. *Poa pratensis* averages 36 percent cover, *Carex integra* 33 percent cover, and *Achnatherum occidentale* 15 percent cover. For forbs, *Achillea millefolium* averages 23 percent and *Potentilla gracilis* 20 percent cover along with 12 percent cover for *Perideridia parishii* and 12 percent cover for the annual *Polygonum douglasii*. A number of other species of graminoids and forbs are present at low cover and constancy. Occasionally *Juncus mexicanus* can have high cover, but it is infrequent.

**Yosemite and environs**
Stands of *Poa pratensis* herbaceous vegetation form a continuous (90–100%) herbaceous layer of predominantly *Poa pratensis* (51% average cover). A large variety of other herbaceous species are present; the most important constant species include *Potentilla glandulosa, Achillea millefolium, Mimulus guttatus,* and *Potentilla gracilis*. Stands on the east side of the crest may have significant *Wyethia mollis.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5

RANK JUSTIFICATION Widespread in California and western North American mountains.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association is transitional between wet and dry meadow sites. It is ecologically related to the *Elymus glaucus* associations and to *Calamagrostis canadensis, Glyceria striata* (=*Glyceria elata*), and *Solidago canadensis* associations. This is an indicator of past or ongoing disturbance. Many stands were probably initiated by the introduction of seed in livestock feed. This current association description also includes *Poa pratensis - Achillea millefolium* from the preliminary classification.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 98K30, 98K26, 98M72
NRI: 66, 151, 283

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***Carex vesicaria* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Inflated Sedge Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Carex vesicaria* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |

USFWS WETLAND SYSTEM Palustrine

RANGE

**Globally**

This association is known from stands throughout the montane western United States (NatureServe 2002).

**Yosemite and environs**

Stands of this association are found throughout the central montane portions of the park.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of this vegetation type are commonly found in wet meadows, around the edges of montane lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains throughout the western United States. Elevations range up to 9,500 feet in Colorado. They can occur in standing water or on sites that become relatively dry during the later part of the growing season. Many sites are located where beaver ponds have filled with sediment. A wide range of soils are associated with this alliance. Histosols are most common and often have organic accumulations greater than 1 meter thick. Mollisols and Entisols are also associated with this type. Soil texture varies widely from loamy clay to sandy loam.

**Yosemite and environs**

This association has been described from stands in seasonally saturated meadows, on valley floors, and on stream terraces. Elevations range from 6,000–8,200 feet. Slopes are very gentle, and aspect is not diagnostic for the type. Soils are all poorly drained and contain high levels of organic material. Soil varies from muck to silt clay.

MOST ABUNDANT SPECIES

**Globally**

Herbaceous *Carex vesicaria*

**Yosemite and environs**

Herbaceous *Carex vesicaria*

CHARACTERISTIC SPECIES

**Globally**

Herbaceous *Carex vesicaria*

**Yosemite and environs**

Herbaceous *Carex vesicaria*

VEGETATION DESCRIPTION

**Globally**

This association is characterized by the dominance of *Carex vesicaria*, with 20–98 percent cover. Other graminoids can be present and can be codominant. *Juncus balticus, Deschampsia caespitosa, Carex nebrascensis, Carex utriculata, Eleocharis palustris,* and *Glyceria* spp. are some of the more common associated species. Forbs can include species of *Epilobium* sp., *Galium trifidum, Camassia quamash, Symphyotrichum foliaceum (= Aster foliaceus), Equisetum arvense,* and *Mentha arvensis*.

**Yosemite and environs**

Stands of this vegetation are heavily dominated by the diagnostic graminoid *Carex vesicaria* (62.5% cover) with highly variable graminoid and forb associates. Graminoids present may include *Deschampsia caespitosa, Carex* spp., and/or *Juncus* spp. The forbs *Epilobium* sp. and *Stachys palustris* occur in trace amounts at about half of the stands. Other forbs, which may be locally common, include *Pteridium aquilinum* (15% cover), *Dodecatheon jeffreyi* (9.3% cover), *Heracleum maximum* (9.3% cover), and/or *Polygonum bistortoides* (9.3% cover). Several other species may occur at trace amounts and low frequencies.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4Q

RANK JUSTIFICATION

DATABASE CODE CEGL002661

COMMENTS
**Globally**
This type appears to be a simple dominance type with *Carex vesicaria* and occasionally *Carex uliginosa* as the only species of significance.

**Yosemite and environs**
It is easy to mistake *Carex vesicaria* for *Carex uliginosa* without the fruits. Both species are ecologically similar, although *Carex vesicaria* tends to be more prevalent at edges of water bodies that draw down significantly through the wet season.
**Plots used to describe association (n=8)**
USGS–NPS Veg Data: 99K102, 99K113, 99K115, 99S133
Potter: 1613, 1611, 1615, 1649

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***Carex utriculata* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Northwest Territory Sedge [Beaked Sedge] Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Carex (rostrata, utriculata)* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association has been defined within Sequoia National Park and Inyo National Forest (Halpern, 1986; Taylor, 1984). The alliance has been defined for many of the United States and Canada, but descriptions of associations solely dominated by *Carex utriculata* are lacking except for the Sierra Nevada.

**Yosemite and environs**
Stands of *Carex utriculata* herbaceous vegetation were sampled within the Tenaya Lake, Tamarack Flat, Tioga Pass, and Ackerson Mountain 7.5-minute and Hetch Hetchy Reservoir 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
The association occurs under a variety of topographic and hydrologic regimes. Under deeply pooled water, pure stands of *Carex rostrata* develop. On sloping sites or under conditions of decreased water tables, *C. rostrata* abundance and vigor decrease and species diversity increases in moderately open basins of the mixed conifer forest zone (Halpern, 1986).

**Yosemite and environs**
Stands of *Carex utriculata* herbaceous vegetation are found at low to high elevations (4,600–9,800 feet) on flat to gentle (0–2 degrees) slopes with all aspects. These sites are located on basin floors, valley bottoms, meadows, and at the edges of lake and ponds where soils are semipermanently to permanently flooded. Soils are silty loam to muck on a granitic substrate. They are poorly drained and often very poorly drained. Litter cover varies ranging from 15–100 percent cover. Fire and disturbance are uncommon at these sites.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Carex utriculata* (Halpern, 1986; Taylor, 1984)

**Yosemite and environs**
Herbaceous *Carex utriculata*

CHARACTERISTIC SPECIES
**Globally**
Herbaceous *Carex utriculata* (Halpern, 1986; Taylor, 1984)

**Yosemite and environs**
Herbaceous *Carex utriculata*

VEGETATION DESCRIPTION
**Globally**
Detailed descriptions for this association are lacking. The literature suggests that the stands are strongly dominated by *Carex uliginosa* (Halpern, 1986; Taylor, 1984).

**Yosemite and environs**
Stands of *Carex utriculata* herbaceous vegetation form an open to continuous herbaceous layer dominated by *Carex utriculata*. The presence of other species that may also be common in this association vary and may include *Scirpus microcarpus, Dodecatheon jeffreyi, Polygonum bistortoides, Potamogeton gramineus, Schoenoplectus acutus* var. *acutus, Eleocharis parishii, Camassia quamash* ssp. *breviflora, Eleocharis palustris, Heracleum maximum, Juncus chlorocephalus, Scirpus diffuses, Moss* spp., *Hypericum anagalloides,* and *Eleocharis pauciflora.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION This association is common in the Sierra Nevada and may occur elsewhere in the western United States.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
It is easy to mistake *Carex vesicaria* for *Carex utriculata* without the fruits. Both species are ecologically similar, although *Carex vesicaria* tends to be more prevalent at edges of water bodies that draw down significantly through the wet season.

**Plots used to describe association (n=11)**
USGS–NPS Veg Data: 98K74, 98M85, 98K69, 98K97, 98M90, 99S108, 99S136
Potter: 1607, 1609, 1663, 1030

## *CAREX AQUATILIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Water Sedge Seasonally Flooded Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |

Associations from this alliance were not defined in this project due to an insufficient number of samples. However, this alliance is usually found in small stands associated with low gradient streams and ponds from the lower montane to the alpine zone on the west slope (approximately 1500-3050 m), and the conifer zone on the east slope (approximately 2100-2750 m). It is often adjacent to willow thickets or low gradient stream and pond sedge stands such as *Carex utriculata* association. A *Carex aquatilis-Carex utriculata* Herbaceous Vegetation association in this alliance has been described from Montana, Wyoming, Colorado and New Brunswick (NatureServe 2003). Further sampling is required to describe local expression. One unclassified alliance-level sample was collected.

USGS–NPS Veg Data: 98K82

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## *Carex nebrascensis* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Nebraska Sedge Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Carex nebrascensis* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

These wetlands occur along the margins of streambanks, lakes, and seeps on the western Great Plains and into the western mountain regions of the United States. Don Potter (pers com 2002) has defined this association from 21 plots sampled throughout the Sierra Nevada.

**Yosemite and environs**

Stands of this association have been found outside the park but within the environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

Vegetation types within this seasonally flooded, temperate, or subpolar grassland occur on saturated soils of flat floodplains bordering ponds or pools adjacent to stream channels. Stands also occur on flat marshy areas surrounding springs or wet meadows. Elevations range from sea level in California to 7,900 feet in Colorado. The alluvial soils are heavy clays and silty clay loams with high organic matter content. Soils are alkaline in some sites. Anoxic conditions often occur within 20 centimeters of the surface either in the form of a gleyed layer or abundant

mottling. Soils often remain saturated throughout the summer, but water tables occasionally drop below 1 meter of the soil surface by the end of the growing season. This alliance is dominated by 30–98 percent cover of *Carex nebrascensis*. *Carex nebrascensis* typically occurs on sites where water flows over the surface but does not pond.

**Yosemite and environs**
This wetland association has been found between 6,500–9,200 feet of elevation on flat to gently sloping meadows and stream terraces. Stands are located on both the eastern and western margins of the park. Aspect is not a diagnostic feature of this type. Soils are poorly drained silts and sandy loams with high organic content. Potter (pers com 2002) found little gleying in his plots in the Sierra Nevada.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Carex nebrascensis*

**Yosemite and environs**
Herbaceous *Carex nebrascensis*

CHARACTERISTIC SPECIES
**Globally**
Herbaceous *Carex nebrascensis*

**Yosemite and environs**
Herbaceous *Carex nebrascensis*

VEGETATION DESCRIPTION
**Globally**
This association is dominated by 30–98 percent cover of *Carex nebrascensis*. Other graminoids may include *Eleocharis palustris, Carex praegracilis, Catabrosa aquatica, Calamagrostis stricta, Triglochin maritima*, and *Schoenoplectus pungens* (= *Scirpus pungens*). Forb cover is generally low according to NatureServe alliance level description, but Potter (pers com 2002) has found forb cover high in other parts of the Sierra Nevada including such species as *Polygonum bistortoides, Perderida parish,* and *Mimuilus primuloides*.

**Yosemite and environs**
This association forms intermittent to continuous herbaceous cover heavily dominated by graminoids. *Carex nebrascensis* (70% cover) is the only constant species. Graminoid associates may include *Juncus nevadensis, Glyceria striata (= Glyceria elata), Juncus mexicanus, Juncus* spp., and *Agrostis* spp. Forb cover and constancy are low. *Oxypolis occidentalis* (12.5% cover) may be common in some stands. Other locally common forbs may include *Muhlenbergia richardsonis, Polygonum bistortoides,* and/or *Trifolium monanthum, Trifolium monanthum, T. longipes,* or *T. wormskjoldgi.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4

RANK JUSTIFICATION This association is fairly widespread and secure.

DATABASE CODE CEGL001813

COMMENTS
**Globally**
This association is extremely widespread and associates may vary from region to region. It is possible the association will be subdivided.

**Yosemite and environs**

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 98M109, 99K130, 99K138

SHRUB/SCRUB ASSOCIATIONS OF ECOLOGICAL ZONE III

***Arctostaphylos patula* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Greenleaf Manzanita Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Arctostaphylos patula* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely that this association ranges throughout the Sierra Nevada and perhaps elsewhere in montane California.

**Yosemite and environs**

Stands of *Arctostaphylos patula* shrubland are sampled in the mapping area of Yosemite and environs within the Ackerson Mountain, Cherry Lake South, and El Capitan 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Arctostaphylos patula* shrubland are found at low to midelevations (4,900–8,300 feet) on mid to high portions of slopes with all aspects. The slopes tend to be linear and moderately steep to abrupt (10–70 degrees). This association is found on moderately deep to deep soils and occasionally on shallow soils. Soils are poorly drained to well drained with textures ranging from stony and gravelly to loam from sedimentary and granitic parent materials. Although fires in this type can be small due to resistance to ignition, they can support catastrophic fires once they get started. Litter can contribute to 30–78 percent cover, wood can contribute to 7–30 percent cover, and bare soil can range from 0–35 percent cover. Disturbance in the form of invasion by exotics, logging, improper burning regime, and road and trail construction occur in low to high intensity. Most stands are the result of fire or other natural or unnatural process. Many stands could support conifer woodland or forest with long intervals between fires or other disturbance processes.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Arctostaphylos patula*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Arctostaphylos patula*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Arctostaphylos patula* shrubland form open to moderately dense stands dominated by *Arctostaphylos patula*. Often found in this association are *Abies concolor, Calocedrus decurrens, Quercus kelloggii,* and *Chamaebatia foliolosa.* Occasionally, *Pinus jeffreyi, Quercus kelloggii,* and *Apocynum androsaemifolium* are present. A variety of other species present in this association may include *Carex multicaulis, Ceanothus parvifolius, Ceanothus cordulatus, Chamaesyce serpyllifolia, Lupinus breweri,* and *Prunus emarginata.* Stands of this type consist of 0–5 percent cover at 0–0.5 meter tall, 10–80 percent cover at 0.5–1 meter tall, 0–60 percent cover at 1–2 meters tall, 0–20 percent cover at 2–5 meters tall, 0–30 percent cover at 5–10 meters tall, 0–30 percent cover at 10–15 meters tall, and 0–20 percent cover at 15–20 meters tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5?

RANK JUSTIFICATION Probably a widespread seral association of the mountains of California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Stands of this association are variable in their disturbance regimes. Some are clearly seral to forest types, and others are edaphically controlled, probably persisting from 50 to more than 100 years at least without being invaded by conifers. In the classification of these plots, the analysis showed the dominance of *Arctostaphylos patula* to be influential with little support for the further differentiation based on the variety of associated species.

**Plots used to describe association (n=17)**
USGS–NPS Veg Data: 98M68, 98M73, 99K26
NRI: 276
Wieslander: **513, 517, 293, 769, 578, 570, 403, 695, 304, 292, 264, 207, 307**

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***Ceanothus cordulatus* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Whitethorn Ceanothus Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |

| | |
|---|---|
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Ceanothus cordulatus* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Ceanothus cordulatus* shrubland are sampled in the mapping area of Yosemite and environs throughout the western side of the park within Zone III. Many plots are within the Ackerson Mountain 7.5-minute topographic quadrangle, which has experienced fire recently.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Ceanothus cordulatus* shrubland are found at midelevations (5,500–7,200 feet) on the mid to upper portions of gentle to steep slopes (3–31 degrees). This association is found on all aspects of linear or convex-shaped slopes. Soils are formed on a granitic substrate and are moderately well developed with textures that range from loamy gravelly sand to clay loam. These sites are well drained to poorly drained with soil depths ranging from moderately deep to deep. Fire is common in this association, and litter cover can be high in stands where there has not been recent fire. This is often associated with canopy openings of *Abies concolor* in postburn communities.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus cordulatus* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Ceanothus cordulatus, Arctostaphylos patula* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Ceanothus cordulatus* shrubland form an intermittent to continuous shrub layer dominated by *Ceanothus cordulatus.* Tree species are occasionally present and may include *Abies concolor, Calocedrus decurrens, Pinus*

*lambertiana, Pinus ponderosa,* and *Quercus kelloggii;* however, these are often in the shrub layer and contribute to minor cover. *Arctostaphylos patula* is usually found in the shrub layer. Occasional shrubs include *Ribes roezlii (= Grossularia roezlii), Chrysolepis sempervirens,* and *Ceanothus parvifolius. Prunus emarginata,* and *Prunus virginiana* var. *demissa* can be common in some stands. The herbaceous layer is open and may include *Gayophytum diffusum, Hackelia velutina, Bromus tectorum,* and *Lupinus* sp.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | Likely to be a common seral association under current disturbance regimes in California. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
Many stands are transitional to *Abies concolor-Pinus lambertiana/Ceanothus cordulatus* forest or other associations within the *Abies concolor - Pinus lambertiana* alliance (see those descriptions). The most extensive stands of this association occur in areas where the canopies of white fir-sugar pine alliance and white fir-California red fir alliance have been eliminated by crown fire. Stands along the Tioga Road, which developed following the 1988 fire, were beginning to be overtopped by scattered sapling conifers in the summer of 2002, 14 years after the fire.

**Plots used to describe association (n=13)**
USGS–NPS Veg Data: 98M70, 98K58, 98K62
NRI: 348
Wieslander: **588, 582, 727, 554, 553, 574, 405, 711, 288**

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## *QUERCUS WISLIZENI* SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Interior Live Oak Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |

This alliance is typically found on low elevation slopes, valleys, raised stream benches and terraces with moderately to excessively drained soils. This west slope chaparral is dominated by scrubby *Quercus wislizeni* (interior live oak) with typical mesophytic chaparral associates such as *Aesculus californica* and *Toxicodendron diversilobum*. Two samples were collected, one for each of two associations. Several such stands exist locally below 3,000 ft. in recently burned areas (e.g., in the El Portal area). The influence of fire history on the structure and composition of these stands is not clear at this time. Tree and scrub versions of *Q. wislizeni* stands may best be placed in the same alliance ultimately. Further sampling is required.

USGS–NPS Veg Data: 98K3, 99S14

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## *QUERCUS VACCINIFOLIA* SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Huckleberry Oak Shrubland Alliance** |
| **SYNONONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |

The *Quercus vaccinifolia* shrubland alliance is known only from Yosemite. It is typically found between 1400 and 2600 m on dry, rocky slopes and ridges in the montane to subalpine zones. This west slope montane chaparral is dominated by scrubby *Quercus vaccinifolia* (huckleberry oak) and may mix with mesophytic montane chaparral associates such as *Chrysolepis sempervirens* and *Arctostaphylos patula*. This alliance has been observed near Lake Vernon and near Washburn Point. Further sampling is needed to elucidate the associations present in the region. Sixteen association-level samples were collected among three previously-undescribed associations.

USGS-NPS Veg Data: 98K113 (*Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland [Provisional]); 98K104 (*Quercus vaccinifolia-Arctostaphylos patula* Shrubland)
NRI Data: 235, 280 (*Quercus vaccinifolia* Shrubland [Provisional])
Wieslander Data: 468, 488, 496 (*Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland [Provisional]); 447, 703, 495, 10, 64, 67, 84, 97, 351 (*Quercus vaccinifolia-Arctostaphylos patula* Shrubland)

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***Quercus vaccinifolia - Chrysolepis sempervirens* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Huckleberry Oak - Bush Chinquapin Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Quercus vaccinifolia* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus vaccinifolia - Chrysolepis sempervirens* shrubland are found across moderate to high elevations on the west slope and were sampled within the Falls Ridge 7.5-minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus vaccinifolia - Chrysolepis sempervirens* shrubland are found at mid to high elevations (6,700–8,600 feet) on moderate to somewhat steep slopes (10–20 degrees). Slopes are generally convex in shape. Aspect

ranges from east to west; however, easterly aspects are most frequent. Soils are often poorly developed with textures ranging from stony to loamy sand on granitic parent material. Soils are easily drained to poorly drained, and depths are shallow to moderately deep. Fire is common. Many of these stands occur on granitic domes and are often in association with a sparse emergent layer of *Pinus jeffreyi.*

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Quercus vaccinifolia, Chrysolepis sempervirens*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Quercus vaccinifolia, Chrysolepis sempervirens*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Quercus vaccinifolia - Chrysolepis sempervirens* shrubland have an intermittent to continuous shrub canopy dominated by *Quercus vaccinifolia* and *Chrysolepis sempervirens*. Also in the shrub layer is *Arctostaphylos patula* and *Prunus emarginata* and occasionally *Ceanothus cordulatus.* A variety of other species are found contributing to minor cover including *Achnatherum occidentale* ssp. *californicum, Apocynum androsaemifolium, Arnica nevadensis, Carex hoodii, Carex raynoldsii, Carex rossii, Carex specifica, Elymus elymoides* ssp. *californicus, Erigeron breweri, Holodiscus discolor, Juniperus communis, Juncus parryi, Kelloggia galioides, Penstemon rostriflorus, Pinus contorta* var. *murrayana, Populus tremuloides, Viola purpurea, Pseudotsuga menziesii, Quercus kelloggii,* and *Ribes* sp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to be common in the northern and central Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Many stands are transitional to *Pinus jeffreyi/Quercus vaccinifolia* woodland (see that description).

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K113
Wieslander: **468, 488, 496**

## *Quercus vaccinifolia - Arctostaphylos patula* Shrubland

| | |
|---|---|
| **COMMON NAME** | **Huckleberry Oak - Greenleaf Manzanita Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Quercus vaccinifolia* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been defined on granitic substrates in the Klamath Mountains within Siskiyou and Trinity counties, California (Sawyer and Thornburg, 1977).

**Yosemite and environs**

Stands of *Quercus vaccinifolia - Arctostaphylos patula* shrubland are sampled throughout the mapping area on both the west and occasionally the east side within the Mammoth Lakes 7.5 minute topographic quadrangle of the crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

Sawyer and Thornburg (1977) suggest this association occurs on south- and southwest-facing exposures on open granitic slopes between 5,000 and 7,000 feet elevation in the Klamath Mountains.

**Yosemite and environs**

Stands of *Quercus vaccinifolia - Arctostaphylos patula* shrubland are found at midelevations (7,000–8,500 feet) on flat to steep (0–36 degrees) slopes. Aspects range from northeast to west but are often northeast, east, and southeast. This association is found on sites with often poorly developed soils with textures ranging from stony to stony gravelly loam. Soils are well drained to poorly drained and shallow to moderately deep. Parent material is granitic.

MOST ABUNDANT SPECIES

**Globally**

Shrub *Quercus vaccinifolia, Arctostaphylos patula* (Sawyer and Thornburg, 1977).

**Yosemite and environs**

Shrub *Quercus vaccinifolia, Arctostaphylos patula*

CHARACTERISTIC SPECIES

**Globally**

Shrub *Quercus vaccinifolia, Arctostaphylos patula* (Sawyer and Thornburg, 1977)

**Yosemite and environs**

Shrub *Quercus vaccinifolia, Arctostaphylos patula*

VEGETATION DESCRIPTION

**Globally**

Intermittent to continuous cover of both *Quercus vaccinifolia* and *Arctostaphylos patula* (either may be dominant) with scattered herbs including *Penstemon newberryi* and *Streptanthus tortuosus.* *Pinus jeffreyi, Abies magnifica,* and *Abies concolor* may be emergent (Sawyer and Thornburg, 1977).

**Yosemite and environs**

Stands of *Quercus vaccinifolia - Arctostaphylos patula* shrubland form an intermittent shrub layer dominated by *Quercus vaccinifolia* and *Arctostaphylos patula*. *Pinus jeffreyi* and *Abies magnifica* are occasionally present in the sparse overstory. *Ceanothus cordulatus, Prunus emarginata, Arctostaphylos nevadensis,* and *Garrya fremontii* are often found in the shrub layer. Other shrub species that may be present include *Chrysolepis sempervirens* and *Ceanothus integerrimus (=* var. *californicus).* A variety of herbaceous species found contributing to low cover might include *Achnatherum speciosum, Amelanchier utahensis, Arabis* sp., *Gayophytum diffusum, Juncus parryi, Leptodactylon pungens, Penstemon azureus, Penstemon newberryi,* and *Symphoricarpos rotundifolius.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Likely to be relatively widespread in the central and northern Sierra Nevada, the Southern Cascades, and Klamath Province of California and adjacent Oregon.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Typically a westside association, the stands around Mammoth Mountain on the east side of the crest substantiate the more mesic local climate of this eastern Sierra Nevada setting.

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98K104
Wieslander: **447, 703, 495, 10, 64, 67, 84, 97, 351**

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***Prunus emarginata* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Bitter Cherry Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous Shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate cold deciduous shrubland |
| ALLIANCE | *Prunus emarginata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Prunus emarginata* shrubland are sampled in the mapping area of Yosemite and environs within the Mammoth Lakes, Tenaya Lake, and Mount Dana 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Prunus emarginata* shrubland are found at midelevations (5,900–8,200 feet) on gentle to somewhat steep slopes (5–24 degrees). This association is found on soils with textures ranging from sand to silt loam derived from granitic parent material. Litter cover at these sites can be high (40–70%).

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Prunus emarginata*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Prunus emarginata*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Prunus emarginata* shrubland form a continuous shrub layer dominated by *Prunus emarginata*. *Populus tremuloides* is occasionally present in the overstory. *Prunus andersonii* can be common in the shrub layer. The shrub layer may also consist of low amounts of *Artemisia tridentata, Ribes roezlii, Purshia tridentata, Cercocarpus ledifolius,* and *Symphoricarpos rotundifolius* var. *rotundifolius.* The herbaceous layer may include *Lupinus latifolius, Apocynum androsaemifolium, Elymus elymoides, Gayophytum ramosissimum, Castilleja applegatei, Carex exserta, Carex hoodii,* and *Holodiscus discolor.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably the least widespread of the "montane chaparral or scrubs" in the Sierra Nevada. This association may also occur in the Klamath Mountains and the adjacent high north coast ranges.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association is generally more common on the west side of the Sierra Crest; however, stands do occur near the Mammoth Mountain area and perhaps in other parts of the eastern Sierra Nevada.

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99K105, 98M104, 98M47

***Chrysolepis sempervirens* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Bush Chinquapin Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Chrysolepis sempervirens* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

Although the alliance occurs in the mountains of Oregon and California, this association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is common in Yosemite and environs. It may occur on both the west and the east sides of the crest but is most prevalent on the west side in Zone III.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

In Yosemite and environs, this association is found from approximately 6,000–8,600 feet in elevation. It occurs primarily in low or midslope positions, in boulder fields, near outcrops, and on glaciated surfaces on moderate to somewhat steep slopes with variable aspects. Soil textures are stony loamy sands through silty loams, derived from granite, are moderately well drained to well drained. Litter/Duff cover ranges from 20–80 percent, and averages 48 percent. Sites are upland.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Chrysolepis sempervirens*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Chrysolepis sempervirens*

VEGETATION DESCRIPTION

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is characterized by a high shrub cover dominated by *Chrysolepis sempervirens.* Tree species include *Abies magnifica, Abies concolor,* and *Calocedrus decurrens,* but they are infrequent and have low cover. Shrub cover ranges from 60–90 percent, with the dominant, *Chrysolepis sempervirens,* averaging 49 percent cover. Other shrub species may include *Prunus emarginata, Arctostaphylos patula,* and *Quercus vaccinifolia*; however, none are frequent or have high average cover. Cover of herbaceous species averages 5 percent. No herb species are consistent, but stands may include *Pteridium aquilinum, Apocynum androsaemifolium,* and *Erigeron breweri*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION At this time only known from Yosemite; however, suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

The seral status of this scrub is unclear relative to California red fir and other coniferous species invasion. It is likely that this association is intermediate in moisture requirements between the *Ceanothus cordulatus* and *Prunus emarginata* associations on the mesic side and *Quercus vaccinifolia* and *Arctostaphylos patula* associations on the xeric side of the moisture gradient.

**Plots used to describe association (n=7)**

USGS–NPS Veg Data: 98K60, 99S166, 98K126, 99K116, 99S116
Wieslander: **243, 294**

FOREST AND WOODLAND ASSOCIATIONS OF ECOLOGICAL ZONE III

## POPULUS TREMULOIDES FOREST ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen Forest Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |

This alliance is widespread in the western United States, the northern Great Plains, and extends into the western Great Lakes area (NatureServe 2007). Throughout this range the alliance consistently occurs in mesic habitats (e.g., lower slopes, near watercourses, basins). Soils are usually deep, well-developed, and loamy. The shrub layer often consists of species of *Salix*, *Prunus*, *Corylus*, *Symphoricarpos*, and *Amelanchier*. The herbaceous layer commonly has species of *Thalictrum*, *Maianthemum* (=*Smilacina*), and *Carex*.

This alliance is represented locally by eight associations, two described by Potter (1998) and six defined by data from this project. Common associated conifers are *Pinus contorta* var. *murrayana* and *P. jeffreyi*. There is commonly an *Artemisia tridentata* component east of the Sierra Nevada crest; stands west of the crest commonly have herbaceous understories or mesophytic shrub species with or without the presence of *Pinus contorta* var. *murrayana*. This alliance has been widely observed in mesic habitats between approximately 2000 and 3200 m. Notable stands occur at Glen Aulin, Rancheria Mountain, and Merced Lake (Botti 2001).

### *Populus tremuloides/Veratrum californicum* Forest

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/California False Hellebore Forest** |
| **SYNONYM** | **Quaking Aspen/California Corn Lily (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is known from the Sierra Nevada, particularly on the west side of the range (Potter 1998). It is the typical quaking aspen association of the meadow edges on the west side of the crest. These stands are usually surrounded by Zone III conifer forests and occur adjacent to meadows.

**Yosemite and environs**

Stands of this association are scattered throughout the montane regions of the park and environs, particularly on the west side of the crest, but may occur on the east side as in Lundy Canyon.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is usually considered a low lying meadow edge type with most stands occurring between 6,500 and 8,000 feet (Potter 1998). Aspects are varied and not significant in distinguishing this type, and slopes are gentle to flat. Stands lie on the lower third of slopes or bottoms and are often part of meadow or riparian complexes. There is abundant moisture available in these sites.

**Yosemite and environs**

This association is found on gentle lower slopes, toe slopes, benches, and basins from 6,000–8,500 feet of elevation. Sites have ample soil moisture. Aspects are varied.

MOST ABUNDANT SPECIES

**Globally**

This association has been described from the central and southern Sierra Nevada (Potter, 1998).

| | |
|---|---|
| Tree: | *Populus tremuloides* |
| Shrub: | |
| Herb: | *Osmorhiza berteroi, Elymus glaucus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Symphoricarpos acutus* |
| Herbaceous | *Osmorhiza berteroi, Elymus glaucus* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Ribes roezlii* |
| Herbaceous | *Veratrum californicum, Elymus glaucus* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Symphoricarpos acutus* |
| Herbaceous | *Veratrum californicum, Elymus glaucus* |

VEGETATION DESCRIPTION

**Globally**

Stands are usually mixed hardwood and conifer forests with quaking aspen mixing with *Abies concolor* and *Abies magnifica* (Potter 1998). Occasionally *Pinus contorta* is present. Shrubs are generally unimportant, but the herb layer is well developed accounting for an average of about 50 percent cover (forbs and graminoids combined).

**Yosemite and environs**

This association is a mixed hardwood–conifer forest with high forb and graminoid cover. The tree canopy is dominated by *Populus tremuloides* (25% cover), mixed with one or more conifer species. These species may include *Pinus contorta* (20% cover), *Abies concolor* (10% cover), and/or *Abies magnifica* (10% cover). *Populus tremuloides* often forms a middle layer beneath a scattered upper layer of conifers, but in older stands it is part of the upper canopy as well. The shrub layer is typically sparse in this association. Understories contain a large variety of moist site indicators such as *Veratrum californicum* (2% cover), *Solidago canadensis* (1% cover), *Osmorhiza berteroi* (2% cover), and/or *Lupinus latifolius* (2% cover). Typical graminoids present may include *Elymus glaucus* (10% cover), *Carex utriculata* (2% cover), *Agrostis scabra* (1% cover), and/or *Deschampsia caespitosa* (0.5% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2

| | |
|---|---|
| RANK JUSTIFICATION | This is likely to be a threatened type outside protected areas due to improper grazing and altered fire regimes (see comments below). |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**
This association appears to be similar to *Populus tremuloides/Veratrum californicum* forest (CEGL000621).

**Yosemite and environs**
Stands in this association in Yosemite and elsewhere in the Sierra Nevada are trending toward dominance by conifers (largely *Abies concolor* or *Abies magnifica*). This trend is largely the result of grazing eliminating the resprouts of the quaking aspen and lack of frequent fire resulting in the unrestricted regeneration of conifers (Potter 1998).

**Plots used to describe association (n=8)**
USGS–NPS Veg Data: 99S106, 98K115, 99S167, 99K128
NRI: 18, 19, 37
Wieslander: **712**
Potter (1998) 16 plots outside study area

---

***Abies concolor-Pinus lambertiana/Ceanothus cordulatus* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir- Sugar Pine/Whitethorn Ceanothus Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor-Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Abies concolor-Pinus lambertiana/Ceanothus cordulatus* forest are sampled in the midelevation western portions of the mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Abies concolor-Pinus lambertiana/Ceanothus cordulatus* forest are found at midelevations (6,300–6,800 feet) on variable aspects (northeast to west) on gentle to somewhat steep slopes (3–20 degrees). These sites are generally found on moderately developed soils with soil textures that range from stony to loamy, however, tending toward sandy loam. Soils are well drained to poorly drained, and soil depths are shallow to deep. Parent material is granite. It is likely that most if not all of these stands have experienced recent fire or other processes that enable the understory shrub layer of *C. cordulatus* to develop.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana* |
| Shrub | *Ceanothus cordulatus* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Abies concolor-Pinus lambertiana/Ceanothus cordulatus* forest form an open to moderately continuous tree layer dominated by *Abies concolor* in the overstory tree layer. *Pinus lambertiana* is also characteristic but is less than 5 percent cover. *Pinus jeffreyi* is often a minor component in the tree canopy. *Abies magnifica* is occasionally present. A discontinuous shrub layer is dominated by *Ceanothus cordulatus.* Other shrubs present may include *Chrysolepis sempervirens, Symphoricarpos mollis, Symphoricarpos rotundifolius, Prunus emarginata,* and *Ribes* sp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Because sample plots in this association have a high relative cover of white fir compared to sugar pine, the decision was to initially put this association in the white fir alliance. However, these stands all do have a presence of sugar pine and thus have been moved to the white fir - sugar pine alliance.

**Plots used to describe association (n=4)**
Wieslander: **580, 303, 200, 56**

***Abies concolor-Pinus lambertiana-Pinus jeffreyi* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir- Sugar Pine-Jeffrey Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor-Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Similar stands have been observed elsewhere in the southern Sierra Nevada and in the Peninsular Ranges of California, but not sampled quantitatively (see note below).

**Yosemite and environs**

Stands of *Abies concolor-Pinus lambertiana-Pinus jeffreyi* forest are sampled in the mid-elevation western portions of the mapping area of Yosemite.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. Other similar stands occupy similar environments on granitic mountain slopes in California.

**Yosemite and environs**

Stands of *Abies concolor-Pinus lambertiana-Pinus jeffreyi* forest are found at midelevations (5,800–8,300 feet, mean 6,724 feet) on variable aspects (north to southwest). The highest elevation stands generally occur on southerly or southwesterly facing slopes. Stands occur on flat, gentle to somewhat steep slopes (0–35 degrees, mean 12 degrees). These sites are generally found on soils ranging from shallow to deep, tending toward moderate depth. Soils are generally well drained. Parent material is granite.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana, Pinus jeffreyi* |
| Shrub | Ceanothus cordulatus, *Arctostaphylos patula* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana, Pinus jeffreyi* |
| Shrub | none |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Abies concolor Pinus lambertiana-Pinus jeffreyi* forest form a moderately continuous tree layer dominated by *Pinus lambertiana* in the overstory tree layer (averaging 51% cover). *Abies concolor* is a constant, but tends to be in somewhat lower cover (average 25 percent) *Pinus jeffreyi* is also characteristic and averages a similar 28 percent cover. All other tree species are found in less than 40 percent of the stands and include in order of decreasing frequency; *Calocedrus decurrens, Abies magnifica, Pinus ponderosa, Quercus kelloggii,* and *Q. chrysolepis.* A discontinuous shrub layer is dominated by *Ceanothus cordulatus and Arctostaphylos patula,* both averaging between 13 and 25 percent cover. Other shrubs present may include *Chrysolepis sempervirens, Prunus emarginata, Arctostaphylos nevadensis, Chrysolepis sempervirens* and *Rosa spithamea*, all averaging less than 10% cover and with less than 30 percent frequency.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4S4 |
| RANK JUSTIFICATION | Despite being only defined from Yosemite it is likely that this association occurs in similar areas along most of the west slope of the Sierra |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

Similar stands have been observed elsewhere in the southern Sierra Nevada between Yosemite and Sequoia National Park. Similar stands also occur in southern California mountains as far south as the San Jacinto Range (Riverside Co.). It remains to be seen if these stands are classifiable as the same association.

**Yosemite and environs**

Sample plots in this association have a high relative cover of sugar pine over white fir , but were all sampled in the 1930s. Re-sampling of stands may suggest that white fir has increased cover.

**Plots used to describe association (n=18)**

Wieslander: **637, 639, 174, 448, 479, 641, 723, 749, 774, 733, 772, 316, 170, 154, 489, 460, 355, 160**

---

***Abies concolor - Pinus lambertiana - Abies magnifica* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir - Sugar Pine - California Red Fir Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |

ALLIANCE *Abies magnifica - Abies concolor* Forest Alliance

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

RANGE
**Globally**
*Abies concolor - Pinus lambertiana - Abies magnifica* forest is widespread at lower elevations on the west side of the upper montane of the central and southern Sierra Nevada, California. Stands can be quite extensive but mostly small, covering less than 50 acres in most cases (Potter, 1998).

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Elevations generally lie between 5,800–7,900 feet in elevation but typically below 7,500 feet. Aspects are variable. Stands are usually on middle and lower slope positions. Sites have significantly less surface gravel and a deeper litter layer than most other types. Soils are usually formed in place on granitic bedrock, but some form on colluvium or glacial till. In general, soils are deep and are typically sandy loams or loams and rarely sands. The average water-holding capacity is generally moderate. Soils are typically well drained (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 6,300–7,400 feet in elevation on gentle to somewhat steep slopes, although mostly on moderate slopes. Aspects are variable, although primarily northwest, southwest, and south. Soils are derived from granite and have textures ranging from stony to sandy loams. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**
Tree Abies *concolor, Pinus lambertiana, Abies magnifica* (Potter 1998)

**Yosemite and environs**
Tree *Abies concolor, Pinus lambertiana, Abies magnifica*

CHARACTERISTIC SPECIES
**Globally**
Tree *Abies concolor, Pinus lambertiana, Abies magnifica* (Potter 1998)

**Yosemite and environs**
Tree *Abies concolor, Pinus lambertiana, Abies magnifica*

VEGETATION DESCRIPTION
**Globally**
Stands in this association are dense multilayered forests with a moderate cover of understory shrubs and herbs (Potter 1998). Tree cover averages 76 percent. These stands are often adjacent to and interspersed with *Abies magnifica - Abies concolor* forest and *Abies magnifica - Abies concolor - Pinus jeffreyi* forest on mesic sites. A mix of several species with *Abies magnifica* distinguishes the overstory, but *Abies concolor* and *Abies magnifica* generally dominate, with 33 percent and 32 percent average cover, respectively. *Pinus lambertiana* is characteristically present, with an average 21 percent cover, but it occurs as widely scattered predominants. *Pinus jeffreyi* and *Calocedrus decurrens* are occasional members of these stands. Shrub cover ranges from 5–25 percent, typically occurring in patches or as individual shrubs. *Chrysolepis sempervirens* is the most common shrub, with a 67 percent frequency and 10 percent cover. Other shrubs may include *Symphoricarpos acutus* or *Ribes roezlii*. Herb

cover averages 74 percent, but no single species is frequent or provides significant cover. *Pyrola picta, Kelloggia galioides, Hieracium albiflorum*, and *Pteridium aquilinum* are the most commonly encountered species.

**Yosemite and environs**
In Yosemite and environs, this association is characterized by an average of greater than 5 percent cover each of *Abies concolor, Pinus lambertiana*, and *Abies magnifica.* Mature trees may be over 50 meters in height. Stands are typically mixed-aged with saplings and pole trees of these conifers in the understory. Shrub cover is generally less than 5 percent, and no species is frequent. Shrubs may include *Arctostaphylos nevadensis, Ceanothus cordulatus, Ribes roezlii*, and *Chrysolepis sempervirens*. Herb cover is also low, and no one species is frequent. Some of the more common herbaceous species are *Apocynum androsaemifolium, Hieracium albiflorum*, and *Pteridium aquilinum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION This association represents productive sites in the mid montane zone most of which have been disturbed and altered by timber harvest practices outside of protected areas.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=15)**
USGS–NPS Veg Data: 98K59
NRI: 323, 338, 342, 343, 87, 89, 104, 120
Wieslander: ***179, 731, 546, 302, 177, 286***

---

***Abies concolor - Pinus lambertiana* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir - Sugar Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor - Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory. Potter (pers com 2002) suggests this forest ranges throughout the central and southern Sierra Nevada all the way to the Piute Mountains of Kern County. Similar stands have also been observed in the San Jacinto Mountains in Riverside County (Keeler–Wolf 1990).

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association is found between 5,000–7,300 feet in elevation. Typically, stands are on moderate to somewhat steep slopes, although slopes range from flat to steep. Aspects are variable, but most are north, northwest, west, or southwest. Soil depth is also variable but is generally deep, with textures ranging from gravelly sand to sandy loam. Soils are derived from granitic bedrock. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Abies concolor, Pinus lambertiana*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Abies concolor, Pinus lambertiana*

VEGETATION DESCRIPTION
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is characterized by a dense canopy dominated by *Abies concolor* and *Pinus lambertiana*. *Pinus ponderosa, Quercus kelloggii,* and *Pinus jeffreyi* may also be present. *Abies concolor* is generally represented by sapling, pole, and mature trees, while the other trees may only be present as mature trees. The shrub layer is generally absent, but shrubs that may be present include *Chamaebatia foliolosa, Ceanothus cordulatus*, and *Arctostaphylos patula*. The herb layer is sparse, and the herbaceous species are variable.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION At this time, this association is only known from Yosemite; however, it is suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is the generic version of the *Abies concolor - Pinus lambertiana* forest alliance. It has relatively dense canopy with no characteristic understory shrubs or herbs. It is most easily defined by what it does not contain (see other associations in this alliance).

**Plots used to describe association (n=11)**
Wieslander: **173, 278, 284, 296**, **199, 428, 305, 306, 423, 424**
Potter: 2022

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***Abies concolor - Pinus lambertiana/Maianthemum racemosum* [*Smilacina racemosa*, Hickman 1993]- *Disporum hookeri* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir - Sugar Pine/False Solomon's-seal - Drops of Gold Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor - Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
The *Abies concolor - Pinus lambertiana* forest alliance occurs in mountains or foothill environments from southwestern Oregon to the Colorado Plateau and southern Stony Mountain regions. *Abies concolor - Pinus lambertiana/Maianthemum racemosum – Prosartes hookeri* forest has been described from the northern Sierra Nevada and southern Cascade Ranges in California. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association appears to be uncommon in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
In the northern Sierra, elevations average 5,000 feet, and aspects are northeast, east, and northwest. Slopes range from gentle to steep. The association occurs in upper and midslope positions, and soils are gravelly sandy loams, sandy loams and loams, and are often derived from volcanic substrates.

**Yosemite and environs**
In Yosemite and environs, this association occurs between 6,800–7,300 feet. Aspects are variable, and slopes are moderate to steep. Soils are derived from granite and are loams.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies concolor* |
| Shrub | *Symphoricarpos mollis* |
| Herbaceous | *Maianthemum racemosum, Prosartes hookeri* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor* |
| Herbaceous | *Abies concolor* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana* |
| Herbaceous | *Maianthemum racemosum, Prosartes hookeri* |

**Yosemite and environs**

| | |
|---|---|
| Tree | Abies *concolor, Pinus lambertiana* |
| Herbaceous | *Abies concolor, Maianthemum racemosum* (Note: Wieslander plots have few to no herbaceous species identified.) |

VEGETATION DESCRIPTION

**Globally**

Mature forests have a moderately dense to dense conifer overstory often codominated by variable mixtures of *Abies concolor, Calocedrus decurrens, Pinus lambertiana*, and *Pinus ponderosa*. *Abies concolor* averages 51 percent cover; the other conifers average 11–36 percent cover. The understory is sparse with *Maianthemum racemosum (= Smilacina racemosa)* and *Prosartes hookeri (= Disporum hookeri)* being most prevalent. *Chimaphila menziesii* is also a constant species.

**Yosemite and environs**

In Yosemite and environs, the tree layer consists primarily of *Abies concolor*, which averages 80 percent cover. Shrub cover is variable and may include *Abies concolor* saplings, *Ceanothus cordulatus*, and *Arctostaphylos patula*. The herb layer is predominantly seedling *Abies concolor*, but may include *Pterospora andromedea*. *Maianthemum racemosum* (= *Smilacina racemosa*) is a constant at less than 5 percent cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Likely to be relatively uncommon following extensive logging in these productive forests. In tact stands are almost entirely in protected areas such as wilderness and national parks. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

This association requires further definition in the Yosemite mapping area. It may prove to be somewhat different from the Fites (1993) description, which Potter (pers com 2002) believes does not occur south of the Molculumne River. The herbaceous species indicative of this association are present in the Yosemite area but are relatively uncommon. With further sampling and analysis plots classified into this group locally may better be assigned to the *A. concolor-P. lambertiana-C. decurrens/Adenocaulor bicolor* association.

**Plots used to describe association (n=4)**

NRI: 135, 141, 279
Wieslander: **301**

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***Abies concolor - Calocedrus decurrens - Pinus lambertiana/Cornus nuttallii/Corylus cornuta* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir – Incense Cedar - Sugar Pine/Pacific Dogwood/California Hazel Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor - Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.
**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is found between 5,800–6,200 feet on moderate to somewhat steep slopes, primarily on northern, northwestern, and western aspects. Soils are sandy loams of granitic origin.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Shrub | *Cornus nuttallii, Corylus cornuta* var. *californica* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | Abies *concolor, Calocedrus decurrens, Pinus lambertiana* |
| Shrub | *Cornus nuttallii, Corylus cornuta* var. *californica* |

VEGETATION DESCRIPTION
**Globally**
This association is only known Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

In Yosemite and environs, this is usually a mesic and dense forest with the tree layer composed of greater than 10 percent cover each of *Abies concolor, Calocedrus decurrens,* and *Pinus lambertiana* with an understory cover predominantly composed of *Cornus nuttallii* and *Corylus cornuta* var. *californica,* averaging 5 percent each. Information suggests that herb cover is sparse, but *Adenocaulon bicolor* is present in at least some of the stands.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3

RANK JUSTIFICATION At this time only known from Yosemite, however, suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada. Unlogged stands are rare outside of protected areas.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association may be considered the higher elevation analog to the similar white fir - sugar pine – incense-cedar/american trail plant forest. A preliminary type, the white fir - sugar pine/Pacific dogwood/American trail plant association (*Abies concolor - Pinus lambertiana/Cornus nuttallii/Adenocaulon bicolor* association), has been lumped into this association. These stands are very similar to the *Sequoiadeondron giganteum-Pinus lambertiana/Cornus nuttallii* association with the notable absence of the big tree.

**Plots used to describe association (n=6)**
NRI: 119, 133
Wieslander: **257, 258, 539**
Potter: 332

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***Abies concolor - Calocedrus decurrens - Pinus lambertiana/Adenocaulon bicolor* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir – Incense Cedar - Sugar Pine/American Trail Plant Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor - Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

The association has been described from the northern Sierra Nevada and southern Cascade Ranges in California. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association occurs on cool, moist, gently sloping sites with well developed soils at elevations averaging 4,700 feet. Sites are north-, northeast-, and northwest-facing lower slopes, benches, or swales and are often associated with headwater areas or seasonal streams. Substrates are variable (Fites 1993).

**Yosemite and environs**
In Yosemite and environs, this association occurs on all slope positions at elevations from 4,300–5,700 feet on gentle to steep slopes. Aspects are variable but are primarily eastern. Surface geology is variable, and soils are clay loams, loams, or sandy loams and range from somewhat poorly drained to well drained. Duff cover ranges from 7–90 percent.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Herbaceous | *Adenocaulon bicolor* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Herbaceous | *Adenocaulon bicolor* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Herbaceous | *Adenocaulon bicolor* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Herbaceous | *Adenocaulon bicolor* |

VEGETATION DESCRIPTION
**Globally**
This is a late successional forest characterized by dense, several layered conifer overstory and an herb layer dominated by *Adenocaulon bicolor*. *Abies concolor, Calocedrus decurrens,* and frequently *Pseudotsuga menziesii* codominate all layers of the diverse overstory. *Pinus lambertiana* is consistently a minor associate. *Pinus ponderosa* sometimes occurs in low amounts. Regeneration is dominated by *Abies concolor* and *Calocedrus decurrens*, but *Pseudotsuga menziesii* and *Pinus lambertiana* are frequent in low amounts. The shrub layer is variable with no shrubs or variable amounts of *Symphoricarpos mollis. Adenocaulon bicolor* dominates the usually well developed herb layer, indicating moist soils. Other herbs include *Maianthemum racemosum (= Smilacina racemosa), Osmorhiza berteroi (= Osmorhiza chilensis), Galium triflorum,* and *Prosartes hookeri (= Disporum hookeri).*

**Yosemite and environs**
In Yosemite and environs, the multilayered tree canopy is composed primarily of *Abies concolor, Calocedrus decurrens,* and *Pinus lambertiana,* averaging 25 percent, 5 percent, and 21 percent of the cover, respectively, and ranging from 10 to over 50 meters in height. *Cornus nuttallii* and *Quercus kelloggii* provide a very small amount of cover in the tree layer. The shrub layer is variable, ranging from less than 5 to 25 percent cover. *Adenocaulon bicolor* is the most prevalent herb species, averaging 5% cover. Other species in the herb layer, which range from 5 to over 50 percent cover, include *Goodyera oblongifolia, Galium triflorum,* and seedlings or sprouts of *Quercus kelloggii.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | At this time only known from Yosemite, however, suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada. This is likely to be a type heavily impacted by logging over the past 100 years. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**
Potter (pers com 2002) has 42 plots in similar stands from recent sampling in Sierra Nevada. However, almost all are in *Sequoiadendron giganteum* dominated communities and would be considered part of that alliance in this report.

**Yosemite and environs**
The lower elevation analog of *Abies concolor - Calocedrus decurrens - Pinus lambertiana/Cornus nuttallii/Corylus cornuta* forest.

**Plots used to describe association (n=7)**
USGS–NPS Veg Data: 98K19, 99S105, 99S134, 98M69
NRI: 115, 117, 222

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***Abies concolor - Pinus lambertiana - Calocedrus decurrens/Chrysolepis sempervirens* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir - Sugar Pine - Incense Cedar/Bush Chinquapin Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor – Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found in the northern Sierra Nevada and southern Cascade Mountains (Fites 1993).

**Yosemite and environs**
Stands of *Abies concolor - Pinus lambertiana - Calocedrus decurrens/Chrysolepis sempervirens* forest are sampled in the mapping area of Yosemite and environs within the Mariposa Grove 7.5-minute, El Capitan, and Ackerson Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only found at midelevations (4,800–6,200 feet) in the northern Sierra Nevada and southern Cascade Mountains. Sites are usually on mid slopes (range from lower to upper slopes) with variable aspects (east to northwest). Soils are moderately deep to deep from volcanic and granitic parent materials. Coarse fragments are variable but often high. Fire regime is variable due to topographic position (Fites 1993).

**Yosemite and environs**
Stands of *Abies concolor - Pinus lambertiana - Calocedrus decurrens/Chrysolepis sempervirens* forest are found at midelevations (5,800–6,900 feet) on moderate to steep (10–29 degrees) slopes. These stands are found on all aspects but are often on west-facing slopes. Soils are moderately well developed with soil textures ranging from sand to loam, tending toward loams. Soils are moderately well drained to well drained. The parent material is granitic. Fire is common in this association.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana, Calocedrus decurrens, Pinus ponderosa* (Fites 1993) |
| Shrub | *Chrysolepis sempervirens* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana, Calocedrus decurrens, Pinus ponderosa, Pseudotsuga menziesii* (Fites 1993) |
| Shrub | *Chrysolepis sempervirens* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Pinus lambertiana, Calocedrus decurrens* |
| Shrub | *Chrysolepis sempervirens* |

VEGETATION DESCRIPTION
**Globally**
This association is dominated by *Abies concolor* in the continuous tree layer and *Chrysolepis sempervirens* in the open shrub layer. *Calocedrus decurrens* is a consistent minor component. *Pinus lambertiana, Pinus ponderosa, Pseudotsuga menziesii,* and *Pinus jeffreyi* are often present in low amounts. Shrub cover is higher in openings in the stands. *Chrysolepis sempervirens* is dominant and *Symphoricarpos mollis* is often present in low amounts. The sparse herb layer includes *Chorizanthe membranacea, Carex rossii, Carex multicaulis, Pyrola picta,* and *Chimaphila umbellata* (Fites 1993).

**Yosemite and environs**
*Abies concolor - Pinus lambertiana - Calocedrus decurrens/Chrysolepis sempervirens* forest is characterized by *Abies concolor, Pinus lambertiana,* and *Calocedrus decurrens* in the overstory tree layer and *Chrysolepis sempervirens* in the shrub layer. Occasionally, *Pinus ponderosa* is also present in the overstory. *Ceanothus cordulatus* is often in the shrub layer and *Arctostaphylos patula* is a common shrub at some sites. Other shrub species that may be found contributing to minor cover include *Corylus cornuta* and *Ceanothus integerrimus.* The herbaceous layer is generally sparse and may include *Adenocaulon bicolor, Pyrola picta,* and a variety of other species contributing to minor cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Probably was widespread in the west side forests of the Sierra Nevada, but old growth stands are rare now. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
*Pseudotsuga menziesii* is not typically a component in the local stands. However, the association is so similar in other respects to the one described by Fites (1993) in the northern Sierra that we are assuming these are synonymous.

**Plots used to describe association locally (n=13)**
NRI: 91, 327, 325, 326, 92, 98
Wieslander: **661, 635, 313, 298, 34, 660, 443**
Fites (1993): 10 plots (northern Sierra Nevada)

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***Abies concolor - Pinus lambertiana - Calocedrus decurrens/Symphoricarpos mollis/Kelloggia galioides* Forest**

| | |
|---|---|
| **COMMON NAME** | **White Fir - Sugar Pine – Incense Cedar/Creeping Snowberry/Milky Kelloggia Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies concolor - Pinus lambertiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found in the northern Sierra Nevada and southern Cascade Mountains (Fites 1993).

**Yosemite and environs**
Stands of *Abies concolor - Pinus lambertiana - Calocedrus decurrens/Symphoricarpos mollis/Kelloggia galioides* forest are sampled in the mapping area of Yosemite and environs within the Lake Eleanor 7.5-minute and Lake Eleanor 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is found at midelevations (3,800–6,300 feet) on gentle, upper to midslopes of varied aspects. Soils are moderately deep to deep from granitic or volcanic parent materials. Stand size is variable but often occupies large areas in the landscape (Fites 1993).

**Yosemite and environs**
Stands of *Abies concolor - Pinus lambertiana - Calocedrus decurrens/Symphoricarpos mollis/Kelloggia galioides* forest are found at low to midelevations (4,600–6,700 feet) on gentle to steep (1–32 degrees) slopes. Aspect varies (northeast to northwest) but is often northwestern. Parent material is typically granitic, and sites are somewhat stony. Fire evidence is common at these sites.

MOST ABUNDANT SPECIES
**Globally**
Tree *Abies concolor, Calocedrus decurrens, Pinus lambertiana, Pinus ponderosa, Pinus jeffreyi*

**Yosemite and environs**
Tree *Abies concolor*

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana, Pinus ponderosa, Pinus jeffreyi* |
| Shrub | *Symphoricarpos mollis* |
| Herbaceous | *Kelloggia galioides* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies concolor, Calocedrus decurrens, Pinus lambertiana* |
| Shrub | *Symphoricarpos mollis* |
| Herbaceous | *Kelloggia galioides* |

VEGETATION DESCRIPTION

**Globally**

This association forms a dense overstory dominated by *Abies concolor*. *Pinus lambertiana* and *Calocedrus decurrens* are consistent minor associates. *Pinus ponderosa* and *Pinus jeffreyi* are often present in varying amounts. *Pseudotsuga menziesii* and *Quercus kelloggii* are occasionally present. The usually sparse understory shrub layer is scattered with *Symphoricarpos mollis*. *Kelloggia galioides* and *Hieracium albiflorum* are present in low amounts (Fites 1993).

**Yosemite and environs**

Stands of *Abies concolor - Pinus lambertiana - Calocedrus decurrens/Symphoricarpos mollis/Kelloggia galioides* forest are dominated by *Abies concolor* in the overstory layer. *Calocedrus decurrens* and *Pinus lambertiana* are also characteristic but less abundant. *Pinus jeffreyi* and *Quercus kelloggii* are common at some stands. *Pinus ponderosa* is occasionally present in some stands. Rarely, *Pseudotsuga menziesii* is present at lower elevations. The shrub layer is very open and is dominated by *Symphoricarpos mollis*. Other shrubs that may also contribute to minor cover include *Ceanothus integerrimus, Ceanothus cordulatus,* and *Chamaebatia foliolosa.* The herb layer is open and includes *Osmorhiza berteroi (= Osmorhiza chilensis), Galium bolanderi, Galium sparsiflorum, Hieracium albiflorum, Apocynum androsaemifolium,* and *Collomia grandiflora.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

As locally represented, this association does not have *Kelloggia galioides* in high constancy. However, all other aspects of this and the Fites (1993) association are identical. We are assuming, therefore, that the two are synonymous.

**Plots used to describe association locally (n=7)**

NRI: 88, 105, 116, 263, 314, 322
Wieslander: **663**
Fites (1993): 11 plots (northern Sierra Nevada)

***Abies magnifica/Wyethia mollis* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir/Woolly Mule-ears Forest** |
| **SYNONYM** | **Red Fir/Mountain Mule Ears Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica/Wyethia mollis* forest is found at the Eldorado and Stanislaus national forests and the Lake Tahoe Basin Management Unit, and it has been observed on the Toiyabe National Forest (Potter, 1998).

**Yosemite and environs**
Occurs locally on volcanics north of Cherry Lake.

ENVIRONMENTAL DESCRIPTION
**Globally**
*Abies magnifica/Wyethia mollis* forest is found at mid to high elevations (6,900–8,300 feet) on gentle to somewhat steep slopes (5–38%) (Potter, 1998). They are usually on southeast- and southwest-facing slopes and on ridges and upper slopes where microrelief is uniform. Soils are derived from volcanic parent material with surface textures of sandy loam to loam and subsurface texture of loams, sandy clay loams, and clay loams. Soil depths are 15–40 inches.

**Yosemite and environs**
See Potter (1998) descriptions.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus jeffreyi* (Potter, 1998) |
| Herbaceous | *Wyethia mollis* (Potter, 1998) |

**Yosemite and environs**
See Potter (1998) descriptions.

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus jeffreyi* (Potter, 1998) |
| Herbaceous | *Wyethia mollis* (Potter, 1998) |

**Yosemite and environs**
See Potter (1998) descriptions.

VEGETATION DESCRIPTION
**Globally**

*Abies magnifica/Wyethia mollis* forest represents typically intermittent woodlands dominated by *Abies magnifica* and *Pinus jeffreyi* (Potter, 1998). Tree distribution is characteristically patchy. *Pinus contorta* and *Pinus monticola* occasionally contribute to low cover. Shrub cover is low with *Symphoricarpos mollis* appearing occasionally. The intermittent understory is dominated by *Wyethia mollis, Monardella odoratissima* ssp. *pallida,* and *Elymus elymoides* ssp. *elymoides*. Other herb species include *Collinsia torreyi* var. *wrightii, Erysimum capitatum* var. *perenne (= Erysimum perenne), Gayophytum eriospermum, Lupinus andersonii,* and *Sidalcea glaucescens*.

**Yosemite and environs**
See Potter (1998) description.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably restricted to the volcanic mudflows of the northern and central Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Although there are no samples locally, this distinctive association has been verified visually from the northern portion on volcanic lahars.

**Plots used to describe association (n=0)**
Potter (1998): 14 samples

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***Abies magnifica - Pinus monticola/Chrysolepis sempervirens* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Western White Pine/Bush Chinquapin Forest** |
| **SYNONYM** | **Red Fir-Western White Pine/Sierra Chinquapin Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica - Pinus monticola/Chrysolepis sempervirens* forest is located at higher elevations primarily in the southern and eastern portions of the upper montane in the central and southern Sierra Nevada, California (Potter, 1998). Yosemite may be near the northern limit of its range. Stand size is usually small, often covering less than an acre on small rock outcrops, but sometimes covering more than 50 acres.

**Yosemite and environs**
This association is moderately common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association typically occurs above 8,000 feet with many stands occurring over 8,500 feet in elevation. Aspects are predominantly northeast and northwest, and the majority of stands are located on upper and middle slopes that are somewhat steep or steeper. Soils are generally derived from granite but may be volcanic or metamorphic in origin and may have evolved in place or formed from alluvium. Soils are typically shallower than most forested sites in the upper montane of the Sierra Nevada. The texture is sand or sandy loam, and the soils are usually excessively drained (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 8,300–8,900 feet in elevation on moderate to steep slopes or on the top of granite knobs. Aspects are variable but primarily northern and western. Soils are derived from granite and have textures ranging from stony, gravelly sands to loams and are well drained. Bare soil ranges from 30–60 percent. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* (Potter, 1998) |
| Shrub | *Chrysolepis sempervirens* (Potter, 1998) |
| Herbaceous | *Arabis platysperma, Achnatherum occidentale* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* (Potter, 1998) |
| Shrub | *Chrysolepis sempervirens* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* |
| Shrub | *Chrysolepis sempervirens* |

VEGETATION DESCRIPTION
**Globally**
Stands are open woodlands with a prominent shrub understory. Overstory composition is characterized by *Pinus monticola* mixed with *Abies magnifica* for a tree cover averaging 51 percent. In some stands, *Pinus monticola* may reach 30 percent cover, but in most cases *Abies magnifica* is the dominant species. Shrub cover averages 29 percent with *Chrysolepis sempervirens* as the dominant species. In some cases *Arctostaphylos patula* is present in substantial amounts, and stands take on the appearance of a mixed shrub plant community. These two shrubs indicate the dry conditions of these stands. The herb layer averages less than 10 percent cover and is composed of widely scattered *Arabis platysperma, Penstemon caesius, Pyrola picta,* and *Erysimum capitatum* var. *perenne (= Erysimum perenne*) (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association has an open tree canopy ranging from 10 meters to over 50 meters in height and dominated by *Abies magnifica*, which has an average cover of 35 percent. *Pinus monticola* cover averages 5 percent. *Juniperus occidentalis* and *Tsuga mertensiana* may be present in low numbers. The shrub layer ranges from
5–30 percent cover, and its composition is variable with *Chrysolepis sempervirens, Artemisia rothrockii, Arctostaphylos patula,* and saplings and poles of *Abies magnifica* being the most common species in the shrub layer.

The herb layer is also variable and ranges from 5–30 percent cover. Herb species include *Eucephalus breweri (= Aster breweri), Castilleja applegatei, Streptanthus tortuosus, Lupinus breweri,* and *Viola purpurea*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION Probably restricted to small stands in the southern and central Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98K70, 98K67
NRI: 331
Wieslander: **668, 338**
Potter (1998): 11 samples

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***Abies magnifica - Pinus monticola* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Western White Pine Forest** |
| **SYNONYM** | **Red Fir-Western White Pine Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica - Pinus monticola* forest is located at higher elevations throughout the central and southern Sierra Nevada, California. Stands can be somewhat extensive, but in most cases they appear to be less than 50 acres in size. It becomes more abundant south of Kaiser Pass (southern Sierra) where *Tsuga mertensiana* begins to lose abundance regionally (Potter, 1998).

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association most frequently occurs above 8,000 feet in elevation (Potter 1998). Aspects can be varied, but sites typically face northeast and northwest. Most stands are on slopes that are somewhat steep or less. This association occurs predominantly on ridges and upper and middle slope positions where microrelief is smooth and uniform.

Soils are generally derived from granite, but parent materials may be volcanic, sedimentary, metamorphic, or mixed. Soils are moderately deep to deep, are commonly sandy loams, and are either well drained or excessively drained.

**Yosemite and environs**
In Yosemite and environs, this association occurs between 8,200–9,200 feet in elevation. It occurs on gentle to steep slopes, although mostly on moderate slopes. Aspects are variable but primarily north and northwest. Soils are derived from granite and have textures ranging from stony, gravelly sands to loams and are well drained. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**
Tree *Abies magnifica, Pinus monticola* (Potter, 1998)

**Yosemite and environs**
Tree *Abies magnifica, Pinus monticola*

CHARACTERISTIC SPECIES
**Globally**
Tree *Abies magnifica, Pinus monticola* (Potter, 1998)

**Yosemite and environs**
Tree *Abies magnifica, Pinus monticola*

VEGETATION DESCRIPTION
**Globally**
Stands are moderately dense forests with little understory vegetation (Potter 1998). Tree cover is significantly higher than other stands with *Pinus monticola*. Overstory layers are characterized by the presence of *Pinus monticola* in a mix with *Abies magnifica*. In rare stands *Pinus monticola* may comprise nearly 50 percent of the crown cover, but generally California red fir has the highest cover values. Understories are quite open. The shrub layer is essentially absent. The sparse forb component is distinguished by the presence of *Eucephalus breweri (= Chrysopsis breweri)* and *Arabis platysperma*, indicating dry sites. *Monardella odoratissima* and *Erysimum capitatum* var. *perenne (= Erysimum perenne)* are other herbs that may be present. Conifer regeneration is high, dominated by *Abies magnifica*.

**Yosemite and environs**
In Yosemite and environs, this association has an open tree canopy ranging from 10 meters up to 35 meters in height. It is dominated by *Abies magnifica* with an average cover of 35 percent, and *Pinus monticola* with cover averaging 26 percent. The shrub layer is generally absent. The herb layer is variable and generally totals less than 5 percent. Herb species may include *Phlox diffusa* and seedling *Abies magnifica*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION Generally restricted to the upper montane belt of the central and southern Sierra Nevada

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=25)**
USGS–NPS Veg Data: 98MCHS2

NRI: 124, 353
Wieslander: **767, 752, 682, 686, 696, 604, 598, 485, 493, 515, 375, 367, 369, 340, 347, 363, 365, 244, 310, 78, 342**
Potter: 2008
Potter (1998): 35 samples

***Abies magnifica - Pinus monticola/Arctostaphylos nevadensis* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Western White Pine/Pinemat Manzanita Forest** |
| **SYNONYM** | **Red Fir-Western White Pine/Pinemat Manzanita Association** (Potter, 1998) |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica - Pinus monticola/Arctostaphylos nevadensis* forest is located on both the east side and west side of the central and southern Sierra Nevada, California. Stand size is not large; however, some sites over 100 acres have been observed (Potter, 1998).

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association typically occurs above 8,000 feet in elevation. Aspects are varied but predominantly southeastern and southwestern. Sites are mostly on ridges and upper and middle slope positions on sites with broken and varied microrelief. Slopes are moderate or somewhat steep. Soils are predominantly derived from granite and may form on bedrock or alluvium or glacial till. Soils are moderately deep; topsoils are shallow and are sands or sandy loams. They are well drained or excessively drained. The available water-holding capacity in these stands is significantly lower than on other sites, although rootable fractures in the bedrock supply additional sources of moisture. Bare ground and surface rock are both significantly higher than most other sites, while litter depths are significantly less (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 7,600–8,600 feet in elevation on moderate to steep slopes. Aspects are variable. Soils are derived from granite and have textures ranging from stony gravel to sandy loams and are moderately well drained. Bare soil ranges from 15–35 percent. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* (Potter, 1998) |
| Shrub | *Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* |
| Shrub | *Arctostaphylos nevadensis* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* (Potter, 1998) |
| Shrub | *Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus monticola* |
| Shrub | *Arctostaphylos nevadensis* |

VEGETATION DESCRIPTION

**Globally**

Stands are open woodlands with an understory of *Arctostaphylos nevadensis*. Total vegetation cover is higher than other plant associations due to the high cover of this shrub; however, tree cover is lower than most types. Overstory composition is characterized by *Pinus monticola* mixed with *Abies magnifica* for a tree cover averaging 43 percent. Shrub cover averages 31 percent, with *Arctostaphylos nevadensis* as the dominant species and *Chrysolepis sempervirens* as an occasional component. The herb layer averages less than 5 percent cover and includes *Arabis platysperma, Elymus elymoides, Pedicularis semibarbata,* and *Achnatherum occidentale* (Potter, 1998).

**Yosemite and environs**

In Yosemite and environs, stands are open woods to 35 meters in height with a shrub understory. Both *Abies magnifica* and *Pinus monticola* cover average between 5 percent and 25 percent. The shrub layer is dominated by *Arctostaphylos nevadensis*, averaging 11 percent cover, but may also contain *Quercus vaccinifolia*. The herb layer is variable and averages less than 10 percent cover. It may include *Apocynum androsaemifolium, Arabis platysperma,* and *Erigeron breweri*.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3S3 |
| RANK JUSTIFICATION | Widespread, though of limited extent throughout the upper elevations of the Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

**Plots used to describe association (n=10)**

USGS–NPS Veg Data: 99K112
NRI: 50, 226, 286
Wieslander: ***761, 673, 674, 670, 456***
Potter: 2009
Potter (1998): 30 plots outside study area

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***Abies magnifica - Pinus monticola - Pinus contorta* var. *murrayana* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Western White Pine - Sierra Lodgepole Pine Forest** |
| **SYNONYM** | **Red Fir-Western White Pine-Lodgepole Pine Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

*Abies magnifica - Pinus monticola - Pinus contorta* var. *murrayana* forest is located on both the upper-elevation east side and west side of the central and southern Sierra Nevada, California. Most samples are located on the Inyo and the Toiyabe national forests but also occur at high elevations on the west side. Stand size can be extensive; most are under 100 acres (Potter, 1998).

**Yosemite and environs**

This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association typically occurs above 8,500 feet in elevation (Potter, 1998). This is the highest elevation association of the mixed *Abies magnifica* and *Pinus monticola* associations. Aspects are varied but are predominantly northeast and northwest. Sites are mostly on ridges and upper and middle slope positions. Slopes are varied ranging from less than 20 percent to greater than 40 percent. Microrelief is variable. Soils are often derived from granite, but a significant number of stands occur on volcanic soils and form on bedrock, alluvium, or glacial till. Soils are typically shallow and are sands or sandy loams. They are generally excessively drained. There is much exposed gravel at the surface. Stands often intermix with mountain hemlock, California red fir, or Sierra lodgepole pine plant associations, where all three mark the transition into the subalpine forests of ecological Zone IV, above.

**Yosemite and environs**

In Yosemite and environs, this association occurs between 7,800–9,500 feet. Most aspects are northerly, ranging from west to east. Soils are derived from granite, have textures ranging from stony gravel to sandy loams, and are moderately well drained. Bare soil ranges from 15–35 percent. Sites are upland.

MOST ABUNDANT SPECIES

**Globally**

Tree *Abies magnifica, Pinus monticola, Pinus contorta* var. *murrayana* (Potter, 1998)

**Yosemite and environs**

Tree *Abies magnifica, Pinus monticola, Pinus contorta* var. *murrayana*

CHARACTERISTIC SPECIES

**Globally**

Tree *Abies magnifica, Pinus monticola, Pinus contorta* var. *murrayana* (Potter, 1998)

**Yosemite and environs**

Tree *Abies magnifica, Pinus monticola, Pinus contorta* var. *murrayana*

VEGETATION DESCRIPTION
**Globally**
Stands are moderately dense forests with sparse understories. Total vegetation cover is generally lower than other forests in the *Abies magnifica* alliance. Overstory composition is characterized by a mix of *Pinus monticola* (mean 16% cover) and *Pinus contorta* var. *murrayana* (mean 21% cover); *Abies magnifica* averages 33 percent cover. Tree cover averages about 63 percent (range 37–91%). Shrub cover is virtually nonexistent, averaging 1 percent (no characteristic species), although conifer regeneration is moderate to high. The herb layer averages about 12 percent cover and includes *Arabis platysperma, Carex rossii, Pedicularis semibarbata,* and *Achnatherum occidentale* as the principal species (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, stands are intermittent to continuous forests with an understory. *Abies magnifica* averages about 50 percent cover, *Pinus contorta* var. *murrayana* about 15 percent, and *Pinus monticola* cover about 12 percent. The shrub layer is very sparse. Only *Ribes montigenum, Quercus vaccinifolia, Arctostaphylos patula,* and *Chrysolepis sempervirens* are occasional, averaging less than 1 percent total. The herb layer is also sparse, averaging 1–2 percent and includes no characteristic species.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION Likely to be widespread, though of limited extent throughout the upper elevations of the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=30)**
NRI: 194, 195, 129, 130, 180, 337, 351, 59, 329
Wieslander: **746, 620, 601, 531, 527, 521, 381, 388 390, 370, 337, 318, 232, 220, 221, 211, 213, 107, 99, 9**
Potter: 2006
Potter (1998): 24 plots outside study area

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***Abies magnifica* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir Forest** |
| **SYNONYM** | **Red Fir Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |

USFWS WETLAND SYSTEM Upland

RANGE

**Globally**

*Abies magnifica* forest is widespread in the central and southern Sierra Nevada in California. It begins to appear above *Abies concolor - Pinus lambertiana* communities at the upper edge of the lower montane. It becomes dominant in the upper montane, and it gradually diminishes into the subalpine zone above. Individual stands range from smaller than 5 acres to extensive tracts covering large areas. Usually, however, single stands are of moderate size with many occupying less than 100 acres (Potter, 1998).

**Yosemite and environs**

This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association can occur at all elevations of the upper montane. Stands on the east side of the Sierra Nevada generally occur between 8,000–9,200 feet. Aspects are variable but often northeast and northwest. Slopes range from gentle to steep. Stands are located on all slope positions, except they seldom occur on ridge tops. Microrelief on most sites is smooth and uniform. Soils are derived primarily from granite with some volcanic in origin. Other parent materials are rare. Soils are significantly deeper than other sites and are usually sandy loams. Soils are typically well drained. This type has significantly lower levels of bare ground and surface gravel than most other sites, and litter cover and depth are significantly higher, reflecting the characteristic high levels of tree cover and debris on the forest floor (Potter, 1998).

**Yosemite and environs**

In Yosemite and environs, this association occurs between 7,000–8,800 feet in elevation on gentle to somewhat steep (although primarily moderate) slopes. Aspects are highly variable. Soils are derived from granite, have textures ranging from stony gravel to loam, and are moderately well drained. Sites are upland.

MOST ABUNDANT SPECIES

**Globally**

Tree *Abies magnifica* (Potter, 1998)

**Yosemite and environs**

Tree *Abies magnifica*

CHARACTERISTIC SPECIES

**Globally**

Tree *Abies magnifica* (Potter, 1998)

**Yosemite and environs**

Tree *Abies magnifica*

VEGETATION DESCRIPTION

**Globally**

Stands are characteristically dense multilayered forests with little ground cover (Potter, 1998). Total tree cover is one of the highest in the upper montane of the Sierra Nevada. The overstory is dominated by a single tree, *Abies magnifica*. Understories are sparse; shrub and herb layers are essentially absent. In rare cases, *Chrysolepis sempervirens, Arctostaphylos nevadensis, Quercus vaccinifolia,* and *Ceanothus cordulatus* may be present in substantial amounts to indicate drier sites. *Ceanothus cordulatus,* while infrequent, is important in the understory due to its ability to rapidly occupy disturbed sites. The herb layer may contain *Corallorhiza maculata, Pedicularis semibarbata, Phacelia hydrophylloides,* and *Pyrola picta*. *Abies magnifica* is the major regenerating species.

**Yosemite and environs**

In Yosemite and environs, stands are open woods to over 50 meters in height with very little understory. Cover of *Abies magnifica*, almost the sole tree species, averages 70 percent. The shrub layer is generally absent. The herb layer is highly variable and averages less than 10 percent cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4S4

RANK JUSTIFICATION This is probably the most extensive association in the *Abies magnifica* alliance.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=37)**
USGS–NPS Veg Data: 98K68
NRI: 94, 96, 121, 142, 272, 285
Wieslander: **616, 618, 5, 657, 677, 678, 600, 602, 610, 548, 551, 562, 464, 484, 368, 343, 345, 312, 206, 222, 66, 185, 483, 494**
Potter: 2012, 2013, 2016, 2017, 2002, 2010
Potter (1998): 160 plots outside study area

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***Abies magnifica/Arctostaphylos nevadensis* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Pinemat Manzanita Forest** |
| **SYNONYM** | **Red Fir/Pinemat Manzanita Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica/Arctostaphylos nevadensis* forest is widespread in the central and southern Sierra Nevada in California, but it appears to be primarily on the west side of the range. Stands can cover large acreages; however, in the majority of cases they are smaller than 10 acres (Potter, 1998). Similar stands defined as *Abies magnifica/ Arctostaphylos nevadensis* (Imper 1988 in Sawyer and Keeler–Wolf 1995) have been described from Mt. Shasta in the southern Cascades.

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**
This association can occur at all elevations of the upper montane, from 7,000–8,800 feet. Aspects are variable. Slopes range from gentle to somewhat steep. Stands are located on all slope positions except toeslopes; however, they are typically found on ridge tops and upper and middle slopes. Litter depths are significantly less when compared to most other associations. Granitic parent materials are common, with volcanic and metamorphic substrates rare. Most soils are formed in place over bedrock and range from 25 to 40 inches deep. Topsoils are usually sandy loams with occasional sands and loams. Coarse fragment content in the subsoils is significantly higher than most other sites associated with this type. Soils are excessively drained. This association is closely related to *Abies magnifica - Pinus monticola/Arctostaphylos nevadensis* Forest vegetationally, but the environments, primarily elevation, coarse fragment content, and textures, differ enough that they are classified separately at this time. Sites are upland (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 6,800–8,000 feet in elevation on moderate to steep slopes. Aspects are primarily western. Soils are derived from granite and have textures ranging from stony, gravelly sand to loam. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| *Tree* | *Abies magnifica* (Potter, 1998) |
| Shrub | *Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica* |
| Shrub | *Arctostaphylos nevadensis* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica* (Potter, 1998) |
| Shrub | *Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica* |

VEGETATION DESCRIPTION
**Globally**
These stands are characteristically open woodlands with a distinctive low-shrub layer of *Arctostaphylos nevadensis* (Potter, 1998). Total vegetative cover is high due to the high cover of this shrub, but tree cover is significantly lower than most other types. Trees tend to occur as scattered clumps or individuals. The overstory is predominantly *Abies magnifica*, but occasional *Pinus jeffreyi* and *Abies concolor* are present, and *Pinus monticola* is rarely present as scattered individuals. Some stands in the association are actually dominated by *Pinus jeffreyi*, although *Abies magnifica* is typically important in these situations. The shrub layer is typified by *Arctostaphylos nevadensis*, but *Chrysolepis sempervirens* is also a somewhat consistent member of the association. The herb component is often sparse and contains a mix of dry and moderate site species. *Arabis platysperma* and *Monardella odoratissima* indicate drier conditions, while *Pyrola picta* and *Viola purpurea* indicate moister sites. *Abies magnifica* is the major regenerating species.

**Yosemite and environs**
In Yosemite and environs, the tree layer is almost solely *Abies magnifica* with relatively open cover between 15 and 50 percent, although *Pinus lambertiana* may occasionally provide a small percentage of the cover in this association. The shrub layer is variable and is composed of *Arctostaphylos nevadensis* averaging 3 percent cover, *Chrysolepis sempervirens* averaging 3 percent cover, *Quercus vaccinifolia* averaging 1 percent cover, and *Ceanothus cordulatus* averaging 2 percent cover. Information on the herb layer is not available.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
This type may range into southern Oregon (J. Kagan pers. comm. 1996).

**Yosemite and environs**
A common and widespread association of the midelevations of the west side.

**Plots used to describe association (n=5)**
Wieslander: **590, 649, 651, 704, 592**
Potter (1998): 28 plots outside study area

---

***Abies magnifica - Pinus contorta* var. *murrayana/Hieracium albiflorum* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - Sierra Lodgepole Pine/Whiteflower Hawkweed Forest** |
| **SYNONYM** | **Red Fir-Lodgepole Pine/White Flowered Hawkweed Association (Potter, 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica - Pinus contorta* var. *murrayana/Hieracium albiflorum* forest occurs throughout the central and southern Sierra Nevada in California. It is a common associate of *Pinus contorta* var. *murrayana/Ligusticum grayi* forest, and, environmentally, conditions in these two types are similar. However, the latter usually occurs on moister sites. Stands can cover extensive areas in gently rolling terrain and drainage bottoms, but usually they are smaller than 10 acres (Potter, 1998).
**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association can occur at all elevations of the upper montane from 7,800–9,500 feet. Aspects are variable but mostly northeast and northwest. Slopes are gentle or moderate. Stands are typically on benches, lower slopes, and in bottom positions adjacent to and somewhat upslope from flat areas such as meadow complexes or drainage bottoms. Stands in this type have significantly less bare ground and surface gravel as compared to most others in the upper montane of the Sierra Nevada, and microrelief is usually smooth and uniform to gently undulating (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 7,200–8,800 feet in elevation on gentle or moderate slopes. Aspects are variable but primarily southeastern and eastern. Soils are derived from granite and have textures ranging from stony gravel to loamy sand. Dead wood cover is high (up to 75%, many sites have been burned fairly recently). Sites are upland.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus contorta* var. *murrayana* (Potter, 1998) |
| Herbaceous | *Hieracium albiflorum* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus contorta* var. *murrayana* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus contorta* var. *murrayana* (Potter, 1998) |
| Herbaceous | *Hieracium albiflorum* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Abies magnifica, Pinus contorta* var. *murrayana* |
| Herbaceous | *Hieracium albiflorum* |

VEGETATION DESCRIPTION
**Globally**
Stands of *Abies magnifica - Pinus contorta* var. *murrayana/Hieracium albiflorum* forest are dense, multilayered forests with understories composed of patches of dense conifer regeneration (Potter, 1998). Average tree cover is one of the highest in the forests of the upper montane of the Sierra Nevada. The overstory is dominated by *Abies magnifica* with an average 49 percent cover, in a mix with *Pinus contorta* var. *murrayana* with an average 20 percent cover. Understories are sparse; shrub cover is among the lowest in the upper montane forests, and shrubs occur in isolated patches or scattered individuals. The herb layer, which averages 8 percent, usually has a mix of mesic and moist site indicators, such as the mesic indicators *Hieracium albiflorum, Viola purpurea,* and *Kelloggia galioides,* and the moist habitat indicators *Osmorhiza berteroi (= Osmorhiza chilensis)* and *Poa bolanderi*. Conifer regeneration is high, dominated by *Abies magnifica*.

**Yosemite and environs**
In Yosemite and environs, stands of *Abies magnifica - Pinus contorta* var. *murrayana/Hieracium albiflorum* forest have dense to open canopies dominated by *Abies magnifica,* averaging between 10 and 50 percent, and *Pinus contorta* var. *murrayana* with an average of greater than 5 percent cover. *Abies concolor* is also frequent with an average cover of 3 percent. The shrub layer is less than 10 percent cover and may include sapling *Abies magnifica, Pinus contorta* var. *murrayana,* and the shrub *Chrysolepis sempervirens.* The herb layer is variable and may be patchy, with the most frequent species being seedling *Abies magnifica* and *Pedicularis semibarbata*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Widespread in the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=17)**
USGS–NPS Veg Data: 98MCHS5
NRI: 127, 128, 125, 126, 97, 106, 95, 188, 266, 339
Wieslander: ***605, 614, 629***
Potter: 2005, 2004, 2014, 2003
Potter (1998): 44 plots outside study area

***Sequoiadendron giganteum - Pinus lambertiana/Cornus nuttallii* Forest**

| | |
|---|---|
| **COMMON NAME** | **Giant Sequoia - Sugar Pine/Pacific Dogwood Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Giant temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Sequoiadendron giganteum* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This forest alliance occurs in limited stands (groves) along the western slope of California's Sierra Nevada, scattered over a 260-mile (420 km) long strip that is less than 15 miles (24 km) wide, with most stands occurring in a 70-mile (112 km) long zone from Fresno to Tulare counties. The association is described from Yosemite and environs but is also tentatively described for Sequoia and Kings Canyon national parks.

**Yosemite and environs**
This association is uncommon in Yosemite and environs. The stands are well known in Wawona, Merced, and Tuolumne groves.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of the association is not available without additional inventory.

**Yosemite and environs**
This association is found in midslope positions on somewhat poorly drained clay loam and loam soils derived from granite. Elevations range from 5,500–7,500 feet, and aspects are variable. Litter/Duff cover averages 85 percent. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**
This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Sequoiadendron giganteum, Pinus lambertiana, Abies concolor, Cornus nuttallii* |
| Shrub | *Cornus nuttallii* |

| | |
|---|---|
| Herbaceous | *Adenocaulon bicolor, Galium triflorum, Asyneuma prenanthoides* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Sequoiadendron giganteum, Pinus lambertiana, Cornus nuttallii* |
| Shrub | *Cornus nuttallii* |

VEGETATION DESCRIPTION
**Globally**
This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
The tree layer over 50 meters averages 40 percent cover and is composed of *Sequoiadendron giganteum* and *Pinus lambertiana*. The tree layer between 10–50 meters is composed of *Abies concolor, Pinus lambertiana,* and *Cornus nuttallii*, averaging a total of 50 percent cover. *Cornus nuttallii* provides an average 25 percent cover in the 1–5 meter shrub layer, while *Corylus cornuta* var. *californica* provides an average of 9 percent. The herb layer varies from
20–80 percent cover and averages 50 percent; *Adenocaulon bicolor* and *Galium triflorum* provide most of the cover in this layer. Other species in the herb layer include *Asyneuma prenanthoides* and *Cornus nuttallii*. Moss cover averages less than 5 percent.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
All three groves of giant sequoia appear to be assignable to the same association.

**Plots used to describe association (n=11)**
USGS–NPS Veg Data: 98M67, 99S104
Wieslander: ***754, 751, 753, 755***
Potter: 2035, 2033, 2034, 2037, 2032

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**PINUS JEFFREYI WOODLAND ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey pine Woodland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |

| | |
|---|---|
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |

Stands of this alliance are found from the Klamath Mountains south through the Coast Ranges, Cascades, and Sierra Nevada to the Tranverse and Peninsular ranges into the Great Basin and south into Baja California, Mexico (NatureServe 2007). Throughout the range of the alliance, stands are commonly on ultramafic-derived soils. Locally, substrates are typically granitic, and stands occur on well-drained shallow to deep soils at moderate to high elevations (1800 – 2650 m). They are typically on moderately steep to steep slopes with sandy loam soils on lower to upper slopes and ridges.

This alliance is dominated by *Pinus jeffreyi*. Other tree species that may be important include *Quercus chrysolepis*, *Abies concolor*, *Abies magnifica*, *Pinus monophylla*, *Pinus contorta* var. *murrayana*, *Pinus ponderosa*, and *Cercocarpus ledifolius*. Important shrub species may include *Purshia tridentata* (east slope), *Artemisia tridentata* (east slope), *Chrysolepis sempervirens*, *Arctostaphylos patula*, *Quercus vaccinifolia*, and *Ceanothus cordulatus*. The herbaceous layer is often sparse and may include *Achnatherum* spp., *Cistanthe monosperma*, *Elymus elymoides*, and other xerophytic species.

This alliance is represented locally by 11 associations, four defined by Potter (1998), one by Taylor (1980), one by Talley (1978), and five newly defined with data from this project. This alliance has been observed at North Dome, Sentinel Dome, Kibbie Lake, Gin Flat, and lower Lee Vining Canyon.

---

***Pinus jeffreyi - Abies magnifica* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine - California Red Fir Woodland** |
| **SYNONYM** | **Jeffrey Pine-Red Fir (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association occurs on the eastern slopes of the upper montane of the Sierra Nevada, California. Stands can be somewhat extensive but in most cases are 10 to 50 acres in size (Potter, 1998).

**Yosemite and environs**
This association is common in Yosemite and environs on the eastern slope of the Sierra Nevada.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association occurs at the highest elevations of all the *Pinus jeffreyi* dominated communities, ranging from 7,300–9,100 feet, but typically above 8,500 feet (Potter 1998). Aspects are generally southeastern through southwestern on slopes that are commonly somewhat steep to steep. Stands commonly occupy upper and middle slope positions. Soils are derived from granitic bedrock or pumice cinders. Soils are characteristically deep and are gravelly sands. Soils are typically excessively drained and are warm, given the dominant aspects.

**Yosemite and environs**
In Yosemite and environs, elevations range from 6,000–9,100 feet, and aspects are characteristically western through southern. Slopes are gentle to very steep, although generally gentle to somewhat steep. Soils are derived from granitic parent material. Soil depth is variable, and textures range from stony gravel to loam.

MOST ABUNDANT SPECIES
**Globally**
Tree Pinus *jeffreyi, Abies magnifica* (Potter 1998)

**Yosemite and environs**
Tree *Pinus jeffreyi, Abies magnifica*

CHARACTERISTIC SPECIES
**Globally**
Tree *Pinus jeffreyi, Abies magnifica* (Potter 1998)
Herbaceous *Arabis platysperma* (Potter 1998)

**Yosemite and environs**
Tree *Pinus jeffreyi, Abies magnifica*

VEGETATION DESCRIPTION
**Globally**
Stands in this association are somewhat open forests with sparse understories composed of scattered shrub and herb patches (Potter, 1998). The overstory is distinguished by the presence of *Pinus jeffreyi,* which averages 26 percent. *Abies magnifica* is generally present as well but sometimes occurs in the middle and lower layers of the tree canopy. *Pinus contorta* var. *murrayana* is an infrequent component of the composition. Shrub cover is very low on most sites; however, in the southern portion of the range stands can be dominated by *Chrysolepis sempervirens*. In the north, *Artemisia tridentata, Purshia tridentata,* and *Chrysothamnus viscidiflorus* are present in a few cases. *Arabis platysperma, Eriogonum nudum,* and *Achnatherum occidentale* are the most frequent species in the herb layer, which averages between 20 and 25 percent cover. Conifer regeneration is among the lowest of any sites in the upper montane. Both *Abies magnifica* and *Pinus jeffreyi* seedlings occur on the majority of sites, although in low numbers.

**Yosemite and environs**
In Yosemite and environs, both *Abies magnifica* and *Pinus jeffreyi* together average less than 50 percent cover in the tree layer. In general, *Pinus jeffreyi* is more important in canopy cover than *Abies magnifica*. The shrub layer is minimal; *Ceanothus cordulatus* and *Quercus vaccinifolia* are in less than half the stands and average 3 percent cover each. Information on the herb layer is scanty due to the preponderance of Wieslander data but suggests a sparse understory with species such as *Monardella odoratissima* and *Lupinus* sp. as widely scattered and uncommon.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably a relatively uncommon type of the central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note the association is part of the Jeffrey pine alliance, not the California red fir alliance. Its open nature and usual dominance by *Pinus jeffreyi* support this assignment.

**Plots used to describe association (n=15)**
NRI: 269
Wieslander: **341, 350, 379, 463, 653, 680, 191, 65, 633, 348, 679, 497, 377, 358**

***Pinus jeffreyi/Chrysolepis sempervirens* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine/Bush Chinquapin Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen Woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been observed in the Sentinel Meadow candidate Research Natural Area within Inyo National Forest, California (Talley, 1978).

**Yosemite and environs**
Stands of *Pinus jeffreyi/Chrysolepis sempervirens* woodland are sampled in the mapping area of Yosemite and environs within the Ackerson Mountain 7-minute topographic quadrangle and elsewhere in the upper montane zone of the park.

ENVIRONMENTAL DESCRIPTION
**Globally**
A similar if not identical association has been described for granitic southerly facing slopes above 7,400 feet elevation at Sentinel Meadow in Inyo County, east of the Sierra Crest (Talley, 1978).

**Yosemite and environs**
Stands of *Pinus jeffreyi/Chrysolepis sempervirens* woodland are found at mid to high elevations (6,900–9,500 feet) on gentle to somewhat steep (3–22 degrees) slopes with variable aspects ranging from northeast to south. Soils are poorly developed to moderately well developed with textures ranging from coarse gravelly sandy to silt loam. These soils are shallow to deep and are usually well drained. Parent material is granitic.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi* (Talley, 1978) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi* (Talley, 1978) |
| Shrub | *Chrysolepis sempervirens* (Talley, 1978) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Chrysolepis sempervirens* |

VEGETATION DESCRIPTION

**Globally**

Stands are dominated by *Pinus jeffreyi* with a mixed understory of *Chrysolepis sempervirens*. *Juniperus occidentalis* var. *australis* is occasional in the tree layer, and there is a sparse understory of herbs including *Streptanthus tortuosus, Cryptantha muricata (*= var. *denticulata),* and *Eriogonum spergulinum* var. *reddingianum* (Talley, 1978).

**Yosemite and environs**

Stands of *Pinus jeffreyi/Chrysolepis sempervirens* woodland are dominated by *Pinus jeffreyi* in the open to intermittent tree canopy and *Chrysolepis sempervirens* in the open to intermittent understory shrub layer. The tree canopy may occasionally include *Abies concolor, Abies magnifica, Pinus lambertiana,* and *Juniperus occidentalis.* Understory species contribute to minor cover and may include *Achnatherum webberi, Apocynum androsaemifolium, Quercus vaccinifolia, Arctostaphylos patula, Cistanthe monosperma, Hydrophyllum occidentale, Lupinus confertus, Maianthemum racemosum* ssp. *racemosum, Pseudostellaria jamesiana, Pyrola picta, Rumex acetosella,* and *Symphoricarpos rotundifolius* var. *rotundifolius.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Probably a relatively localized association of the higher and drier portions of the range of Jeffrey pine. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

The only description of this association is from the east side of the Sierra Nevada in the Mammoth area. This area is relatively moist given its proximity to the low gap in the Sierra Crest, suggesting additional moisture availability than is modal for the Sierra Nevada east side.

**Yosemite and environs**

Stands appear to range from the west to the east slope of the range.

**Plots used to describe association (n=4)**

USGS–NPS Veg Data: 98M62
Wieslander: **359, 384, 201**

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***Pinus jeffreyi/Quercus vaccinifolia* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine/Huckleberry Oak Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Upland

RANGE

**Globally**

This association is found predominantly on the northern portion of the west side of the Sierra Nevada (Potter, 1998).

**Yosemite and environs**

Stands of *Pinus jeffreyi/Quercus vaccinifolia* woodland are sampled in the mapping area of Yosemite and environs within the Tower Peak 15-minute and the Kibbie, Yosemite Falls, and Tiltill Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Pinus jeffreyi/Quercus vaccinifolia* woodland are found at midelevations (6,300–8,300 feet) on variable slopes (4–58%)(Potter, 1998). These sites are typically southeast- and southwest-facing and on the middle, upper, and ridges of slopes. The microrelief of these sites are usually hummocky and broken. Soils have more surface gravel than most nearby associations. Soil depth is moderately deep to deep (13–40+ inches) with textures that are often sandy loam and sand. The topsoil has a high coarse fragment cover. Soils are excessively drained and are considerably less deep than most other upland montane woodland associations.

**Yosemite and environs**

Stands of *Pinus jeffreyi/Quercus vaccinifolia* woodland are found at midelevations (6,100–8,500 feet) on gentle to steep slopes. Soils are poorly developed to moderately well developed with textures ranging from stony to sandy loam from granitic parent material. Soils are easily drained to poorly drained with depths that are shallow to moderately deep. Rock outcrops, predominately granitic, are a common feature of this association.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies concolor, Abies magnifica* (Potter, 1998) |
| Shrub | *Quercus vaccinifolia, Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Quercus vaccinifolia* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies concolor, Abies magnifica* (Potter, 1998) |
| Shrub | *Quercus vaccinifolia, Arctostaphylos nevadensis* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Quercus vaccinifolia* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Pinus jeffreyi/Quercus vaccinifolia* woodland form an open tree layer dominated by *Pinus jeffreyi* and an intermittent to dense understory shrub layer dominated by *Quercus vaccinifolia* (Potter, 1998). *Abies concolor* and *Abies magnifica* are typically found here as well. In some cases *Pinus jeffreyi* is in near equal cover to *Abies concolor* and *Abies magnifica.* The understory is characterized by *Quercus vaccinifolia* with usually lesser amounts of *Arctostaphylos nevadensis* and *Ceanothus cordulatus.* Herbaceous species may include *Pedicularis semibarbata,*

*Arabis platysperma, Eriogonum nudum, Gayophytum eriospermum, Erigeron breweri, Monardella odoratissima* ssp. *pallida, Elymus elymoides* ssp. *elymoides,* and *Achnatherum occidentale*.

**Yosemite and environs**
Stands of *Pinus jeffreyi/Quercus vaccinifolia* woodland form an open tree layer dominated by *Pinus jeffreyi* and an intermittent understory shrub layer dominated by *Quercus vaccinifolia. Juniperus occidentalis, Abies concolor, Pinus contorta* var. *murrayana,* and *Quercus kelloggii* may occasionally be found contributing to low cover in the tree layer. Understory species that may occasionally be present include *Arctostaphylos patula, Ceanothus cordulatus, Gayophytum diffusum* ssp. *parviflorum, Symphoricarpos mollis,* and *Ribes roezlii (= Grossularia roezlii).*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION This is a common type in the midelevations of the northern and central Sierra Nevada and perhaps in the Klamath Mountains as well.

DATABASE CODE To be determined

COMMENTS
**Globally**
The association differs from *Pinus jeffreyi - Abies concolor* forest by typically having a more open canopy (mean 37% tree cover) and the presence of a well developed understory of *Quercus vaccinifolia* and other shrubs.

**Yosemite and environs**

**Plots used to describe association (n=24)**
USGS–NPS Veg Data: 98MCHS4
NRI: 281, 52, 30, 223
Wieslander: **455, 490, 492, 499, 502, 631, 655, 659, 386, 431, 219, 473, 770, 675, 676, 700, 625, 487**
Potter: 2018

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***Pinus jeffreyi - Abies concolor* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine - White Fir Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus jeffreyi - Abies concolor* woodland are sampled in the mapping area of Yosemite and environs within the Tower Peak, Yosemite, Pinecrest, Hetch Hetchy Reservoir, Lake Eleanor, Merced Peak, and Tuolumne Meadows 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus jeffreyi - Abies concolor* woodland are found at mid to high elevations (6,150–8,300 feet) on flat to steep (0–31 degrees) slopes. Aspect varies but is typically xeric including southeast, south, and southwest. These sites are typically found on poorly developed to well developed soils with textures ranging from gravel to loam. Soils are well drained to moderately well drained and shallow to deep. Fire is common, and disturbance levels are usually low at this association.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Pinus jeffreyi, Abies concolor*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Pinus jeffreyi, Abies concolor*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus jeffreyi - Abies concolor* woodland are dominated by *Pinus jeffreyi* and *Abies concolor* in the open overstory layer. Other tree species that may be found contributing to significantly less cover include *Pinus lambertiana, Abies magnifica, Pinus contorta* var. *murrayana, Calocedrus decurrens, Quercus kelloggii, Pinus lambertiana, Populus tremuloides,* and *Juniperus occidentalis. Ceanothus cordulatus* and *Arctostaphylos patula* are often in the understory shrub layer. *Chrysolepis sempervirens, Prunus emarginata, Quercus vaccinifolia, Arctostaphylos nevadensis,* and *Artemisia tridentata* may also be present but in low numbers. *Pteridium aquilinum* var. *pubescens* is often in the herb layer. Other herbaceous species may include *Gayophytum diffusum* ssp. *parviflorum, Apocynum androsaemifolium, Kelloggia galioides, Erigeron breweri, Eriogonum marifolium,* and *Hieracium albiflorum.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

| | |
|---|---|
| RANK JUSTIFICATION | Given the abundance of samples in the Yosemite area, we assume that this association is widespread here and elsewhere at least in the central and southern Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
See comments on *Pinus jeffreyi/Quercus vaccinifolia* Woodland.

**Plots used to describe association (n=39)**
NRI: 51, 24, 93, 21, 28, 38, 58, 164
Wieslander: **349, 12, 335, 647, 357, 500, 503, 504, 506, 508, 509, 519, 568, 595, 469, 478, 491, 380, 383, 376, 245, 246, 247, 332, 352, 353, 93, 471, 472, 475, 471**
Potter (pers. com 2002): Has 7 additional plots from cental and southern Sierra Nevada

---

***Pinus jeffreyi/Arctostaphylos patula* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine/Greenleaf Manzanita Woodland** |
| **SYNONYM** | **Jeffrey Pine/Greenleaf Manzanita-Snowbrush Association (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found at the mid to upper elevations in the Sierra Nevada and appears more commonly in the south and east sides. Stands often cover tens of acres and occasionally cover several hundreds of acres (Potter, 1998).

**Yosemite and environs**
Stands of *Pinus jeffreyi/Arctostaphylos patula* woodland are sampled in the mapping area of Yosemite and environs within the Merced Peak 15-minute, Tower Peak 15-minute, and Tower Peak and Yosemite 15-minute topographic quadrangles and the Hetch Hetchy Reservoir and Ackerson Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
Stands of *Pinus jeffreyi/Arctostaphylos patula* woodland are found at mid to high elevations (6,660–9,520 feet) on gentle to steep (4–64%) slopes of variable, but mostly southeast and southwest, aspects (Potter, 1998). These sites are on middle and upper slopes and ridge tops. There are significantly higher levels of bare ground, surface gravel, and bare rock compared to other sites. This association is found on poorly developed to moderately developed soils. Parent material is most frequently granitic but some are derived from volcanic materials. Soil depths are usually

moderately deep to deep (5–40+ inches), and textures are sand, sandy loams, and loams. Drainage is usually excessive due to coarse soil textures.

**Yosemite and environs**
Stands of *Pinus jeffreyi/Arctostaphylos patula* woodland are found at midelevations (5,700–8,400 feet) on gentle to somewhat steep slopes of variable, but mostly southerly, aspects. This association is found on poorly developed to moderately developed soils with textures ranging from stony to sandy loam on a granitic substrate. These soils are well drained to moderately well drained. Parent material is granitic.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies magnifica* (Potter, 1998) |
| Shrub | *Arctostaphylos patula, Arctostaphylos nevadensis, Ceanothus velutinus* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Arctostaphylos patula* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies magnifica, Abies concolor* (Potter, 1998) |
| Shrub | *Arctostaphylos patula, Arctostaphylos nevadensis, Ceanothus velutinus, Chrysolepis sempervirens* (Potter, 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Arctostaphylos patula* |

VEGETATION DESCRIPTION
**Globally**
Stands of the *Pinus jeffreyi/Arctostaphylos patula* woodland form an open tree layer underlain by a dense shrub layer. The open tree canopy is dominated by *Pinus jeffreyi*. *Abies magnifica* is often present, and *Abies concolor* is occasionally present. In some cases, *Pinus jeffreyi* is less abundant than *Abies magnifica* and *Abies concolor*. The shrub layer consists of *Arctostaphylos patula* or *Ceanothus velutinus* (on the east side of Sierra Nevada). Other shrubs also found in this association include *Chrysolepis sempervirens (= Castanopsis sempervirens), Ceanothus cordulatus, Arctostaphylos nevadensis,* and *Prunus emarginata.* The open herb layer may include low cover of *Arabis platysperma* var. *howellii, Gayophytum eriospermum, Pedicularis semibarbata, Cistanthe umbellata (= Calyptridium umbellatum), Erigeron breweri, Eriogonum nudum, Monardella odoratissima* ssp. *pallida, Erigeron peregrinus, Elymus elymoides,* and *Achnatherum occidentale* (Potter, 1998).

**Yosemite and environs**
Stands of *Pinus jeffreyi/Arctostaphylos patula* woodland form an open tree and shrub layer. The open tree canopy dominated by *Pinus jeffreyi* is occasionally associated with *Calocedrus decurrens, Abies concolor, Pinus ponderosa, Juniperus occidentalis, Quercus kelloggii, Abies magnifica, Pinus contorta, Pinus monticola, Pinus lambertiana, Quercus chrysolepis,* and *Pseudotsuga menziesii.* *Arctostaphylos patula* dominates the shrub layer. Other shrubs also found in this association include *Ceanothus cordulatus, Chrysolepis sempervirens, Arctostaphylos viscida, Arctostaphylos nevadensis,* and *Quercus vaccinifolia.* The open herb layer may include low amounts of *Pellaea mucronata* ssp. *mucronata, Bromus tectorum, Gayophytum diffusum* ssp. *parviflorum, Clarkia rhomboidea, Poa secunda,* and *Monardella odoratissima* ssp. *pallida.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G4? |
| RANK JUSTIFICATION | This association is likely to be relatively common throughout the Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=17)**
NRI: 36, 56, 45, 47, 228
Wieslander: ***208, 550, 584, 501, 73, 156, 60, 576, 62, 216, 297, 193***

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***Pinus jeffreyi/Ceanothus cordulatus* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine/Whitethorn Ceanothus Woodland** |
| **SYNONYM** | **Jeffrey Pine/Mountain Whitethorn-Sagebrush Association (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association ranges throughout the upper montane of the central and southern Sierra Nevada in California, although stands become more common to the north of the San Joaquin River and in the eastern Sierra Nevada (Potter, 1998).

**Yosemite and environs**
This association is uncommon in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Elevations range from 6,800–9,400 feet, but stands are most commonly below 8,000 feet. Aspects are usually southeastern through southwestern on slopes that are gentle or moderate. Stands are located in middle and lower slope positions. Soils are usually formed in place over granitic or volcanic bedrock and are generally deep, sandy loams. Soils are usually excessively drained, and soil temperatures are among the highest in the upper montane of the Sierra Nevada. Litter thickness is generally less, and cover of bare ground and gravel is generally more than other types (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, elevations range from 5,900–7,200 feet, and aspects are variable.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi*, *Abies magnifica* (Potter 1998) |
| Shrub | *Ceanothus cordulatus* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus jeffreyi* (Potter 1998) |
| Shrub | *Ceanothus cordulatus* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Ceanothus cordulatus* |

VEGETATION DESCRIPTION

**Globally**

Stands in this association are open woodlands with scattered, sometimes large patches of shrubs. Total tree cover is among the lowest of the forested associations of the upper montane of the Sierra Nevada. The shrub cover is significantly higher than other sites. The overstory is distinguished by the presence of *Pinus jeffreyi*, which averages 16 percent cover. *Abies magnifica* is generally present, with an average 15 percent cover, and *Pinus contorta* var. *murrayana* and *Abies concolor* may occasionally also be present. In a few cases, *Pinus jeffreyi* may be the only member of the overstory, while other stands may be dominated by *Abies magnifica, Pinus contorta* var. *murrayana,* and *Abies concolor*. In these cases the understories are dominated by *Ceanothus cordulatus, Artemisia tridentata, Purshia tridentata,* or *Chrysothamnus viscidiflorus* and indicate the association. The shrub layer is often a mix of species in two distinct types that occur on the westside or eastside forests. Westside stands are dominated by *Ceanothus cordulatus* sometimes mixed with *Artemisia tridentata*. Eastside stands can be dominated by any one of four species: *Ceanothus cordulatus, Artemisia tridentata, Purshia tridentata,* or *Chrysothamnus viscidiflorus*. Usually two of the four species occur on any particular site, but stands dominated by *Artemisia tridentata, Purshia tridentata,* or *Chrysothamnus viscidiflorus* on the east side generally do not contain *Ceanothus cordulatus*. West side stands tend to be clearly dominated by *Ceanothus cordulatus*, whereas eastside stands tend to be mixed low-shrub communities. *Arabis platysperma, Gayophytum eriospermum, Elymus elymoides,* and *Achnatherum occidentale* are the most frequent species in the herb layer, which varies depending on soil moisture. Conifer regeneration is low, with no one species dominating (Potter, 1998).

**Yosemite and environs**

In Yosemite and environs, this association generally consists of a dense shrub layer dominated by *Ceanothus cordulatus* with emergent *Pinus jeffreyi* trees; however, in one stand, *Ceanothus cordulatus* cover was 1 percent. *Pinus jeffreyi* averages 35 percent cover. Other trees that may be present in low numbers are *Calocedrus decurren*s and *Abies concolor*. In the shrub layer, *Ceanothus cordulatus* averages 53 percent cover. The shrub species *Arctostaphylos patula* and *Prunus emarginata* may also be present in low numbers. The herb layer is sparse, and the species variable.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | This type is relatively uncommon in Yosemite and probably elsewhere. However it has been sampled from Lake Tahoe to Onion Valley. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

Because of the divergence of shrub understories in eastside and westside settings in Potter's (1998) descripion, there may be reason enough to consider splitting this into an eastside and a westside association. The *Pinus jeffreyi/Purshia tridentata* woodland (Taylor, 1980) defined and described as an eastside woodland of Zones VII and VIII is equivalent to the eastside segment of this Potter (1998) type. The Yosemite description of *Pinus*

*jeffreyi/Ceanothus cordulatus* pertains strictly to those open stands of *P. jeffreyi* with an understory dominated by *Ceanothus cordulatus*.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99K106
NRI: 350, 57
Potter (pers. com 2002): has 18 plots outside of study area

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***Abies magnifica - Abies concolor - Pinus jeffreyi* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - White Fir - Jeffrey Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica - Abies concolor* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Abies magnifica - Abies concolor - Pinus jeffreyi* forest is widespread at middle to lower elevations in the central and southern Sierra Nevada, California. Stands range from smaller than 5 acres to over 100 acres (Potter, 1998).

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Elevations generally lie between 6,500–8,000 feet. Aspects are variable, but a significant portion lie on southern slopes where solar radiation levels are significantly higher than most other sites. Stands are usually on upper slopes, and some are on ridge tops. Slope angles are moderate to somewhat steep. Stand size is usually small, often covering less than an acre on small rock outcrops but sometimes covering more than 50 acres. Sites have significantly less surface gravel and a deeper litter layer than drier sites commonly encountered. Soils are usually formed in place on granitic bedrock, but often form on alluvium, colluvium, or glacial tills and outwash. In general, soils are deeper than most other sites. Soils are typically sandy loams with rare sands and loams. The average water-holding capacity is one of the highest in the upper montane of the Sierra Nevada. Soils are typically well drained (Potter, 1998).

**Yosemite and environs**
In Yosemite and environs, this association occurs between 6,300–7,900 feet in elevation on moderate to somewhat steep slopes. Aspects are variable. Soils are derived from granite; have textures ranging from stony, gravelly, sandy loams to sandy loams; and are moderately to well drained. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**
Tree *Abies magnifica, Abies concolor, Pinus jeffreyi* (Potter 1998)

**Yosemite and environs**
Tree *Abies magnifica, Abies concolor, Pinus jeffreyi*

CHARACTERISTIC SPECIES
**Globally**
Tree *Abies magnifica, Abies concolor, Pinus jeffreyi* (Potter 1998)
**Yosemite and environs**
Tree *Abies magnifica, Abies concolor, Pinus jeffreyi*

VEGETATION DESCRIPTION
**Globally**
These are moderately dense forested stands with light understory vegetation (Potter 1998). Overstory layers are distinguished by the presence of *Abies concolor* and *Pinus jeffreyi*, averaging 16 and 18 percent cover, respectively, in a mix with *Abies concolor*, with an average 29 percent cover in the overstory. Understories are somewhat sparse. Occasionally *Chrysolepis sempervirens* can become a major component in the shrub layer and dominate understories, but in most cases shrubs occur as scattered patches and individuals. The herb layer most often contains *Pedicularis semibarbata, Kelloggia galioides, Hieracium albiflorum, Viola purpurea,* and *Pyrola picta,* although none of these is frequent. An important element in these understories is the presence of several shrub and forb species that occur at low frequency but can dominate sites in early successional sequences. In the shrub layer, these are *Ceanothus cordulatus, Prunus emarginata, Arctostaphylos patula,* and *Chrysolepis sempervirens*. In the herb layer, they include *Pteridium aquilinum, Lupinus adsurgens, Lupinus andersonii,* and *Achnatherum lemmonii*. *Abies magnifica* and *Abies concolor* are the most common tree species regenerating; *Pinus jeffreyi* regeneration is low.

**Yosemite and environs**
In Yosemite and environs, this association is characterized by an average of 25 percent cover of *Abies concolor* and between 5 percent and 25 percent cover of *Abies magnifica* and *Pinus jeffreyi.* Trees may attain heights up to 50 meters. Shrub cover is typically open (less than 5%). Shrubs may include *Arctostaphylos nevadensis, Ceanothus cordulatus,* and *Chrysolepis sempervirens.* Herb cover is also low, averaging between 5 and 10 percent, and no species is frequent. Species with the highest cover include *Pedicularis semibarbata, Angelica breweri, Galium bolanderi,* and *Senecio integerrimus* var. *exaltatus*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION Probably moderately common, but stands have been impacted by logging throughout most of the range of this type.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98M65, 99K125
NRI: 90, 100, 275
Wieslander: ***54, 627, 51, 523***
Potter: 2021

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***Abies magnifica - Abies concolor* Forest**

| | |
|---|---|
| **COMMON NAME** | **California Red Fir - White Fir Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Abies magnifica - Abies concolor* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

*Abies magnifica - Abies concolor* forest is widespread in the central and southern Sierra Nevada, California. Stands range from smaller than 5 acres to several hundred acres (Potter, 1998).

**Yosemite and environs**

This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is located at middle to lower elevations, generally ranging from 6,500–8,800 feet (Potter 1998). Aspects are variable, but northeast to northwest slopes are common, and average solar radiation levels are among the lowest in the region. Slopes are gentle to steep. Stands occur on all slope positions. Sites have significantly less bare ground and surface gravel and a deeper litter layer than other sites. Soils are usually formed in place on granitic bedrock. In general, soils are deeper than most other sites and are usually sandy. The average water-holding capacity is one of the highest in the upper montane of the Sierra Nevada. Soils are typically well drained.

**Yosemite and environs**

In Yosemite and environs, this association occurs between 6,300–8,600 feet in elevation on flat to somewhat steep slopes, although most commonly on moderate and somewhat steep. Aspects are variable but primarily northern and western. Soils are derived from granite and have textures ranging from stony gravels to loams. Sites are upland.

MOST ABUNDANT SPECIES

**Globally**

Tree *Abies magnifica, Abies concolor* (Potter 1998)

**Yosemite and environs**

Tree *Abies magnifica, Abies concolor*

CHARACTERISTIC SPECIES

**Globally**

Tree *Abies magnifica, Abies concolor* (Potter 1998)

**Yosemite and environs**

Tree *Abies magnifica, Abies concolor*

VEGETATION DESCRIPTION

**Globally**

Stands in this association are dense, multilayered forests with somewhat open overstories (Potter 1998). They are often adjacent to or interspersed with *Abies concolor - Pinus lambertiana - Abies magnifica* forest and *Abies magnifica - Abies concolor - Pinus jeffreyi* forest on mesic sites. Overstories are distinguished by the presence of

*Abies concolor* with an average 25 percent cover in a mix with *Abies magnifica* with an average 55 percent cover, and together these species dominate the stands. Understory shrub cover is significantly lower than other associations in late seral stands, averaging 3 percent. *Symphoricarpos acutus, Chrysolepis sempervirens,* and *Ribes roezlii* are the most common shrubs, but none are frequent. Herb cover is also low, averaging 15 percent, and while no species are frequent, the most common ones are *Pyrola picta, Hieracium albiflorum,* and *Corallorhiza maculata*. *Abies magnifica* is the dominant regenerating conifer.

**Yosemite and environs**
In Yosemite and environs, this association is characterized by an average 2 percent cover of *Abies concolor* and 2 percent cover of *Abies magnifica*. The understory shrub layer is minimal; *Chrysolepis sempervirens* has the highest frequency (48%) and cover (less than 0.5%).

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3S3 |
| RANK JUSTIFICATION | Probably was relatively widespread in the central and southern Sierra Nevada, but stands reduced in extent and quality by logging. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=23)**
Wieslander: **599, 507, 458, 459, 56, 187, 203, 205, 53, 446, 427, 771, 552, 309, 319, 322, 327, 329, 189, 300, 325**
Potter: 653

ECOLOGICAL ZONE IV: SUBALPINE FORESTS, WOODLANDS, AND MEADOWS OF THE WEST SLOPE

HERBACEOUS ASSOCIATIONS

### *OREOSTEMMA ALPIGENUM VAR. ANDERSONII* (*Aster alpigenus* var. *andersonii*, Hickman 1993) HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Alpine Aster Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar forb vegetation |

Associations from this alliance were not defined in this project due to an insufficient number of samples. However, stands are found in moist meadows that are strongly dominated by alpine aster, *Oreostemma alpigenum* var. *alpigenum* (syn. *Aster alpigenus* ssp. *andersonii*). These stands are related to the *Carex nigricans* Alliance (see300A.1Bb.1b.4) and the *Calamagrostis breweri* Alliance. A *Calamagrostis breweri- Oreostemma alpigenum* Herbaceous Vegetation association in the *Calamagrostis breweri* Alliance has been described from the Sierra Nevada of California (NatureServe 2003) Currently, these stands are strongly dominated by alpine aster with low or no cover of other similar-alliance species. Further sampling is required. One unclassified alliance-level sample was collected.

USGS-NPS Veg Data: 98K88: (Alliance level only)

### *ARNICA MOLLIS* HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Hairy Arnica Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Tall temperate or subpolar forb vegetation |

Associations from this alliance were not defined in this project due to an insufficient number of samples. However, these stands are strongly dominated by *Arnica mollis* and are found in moist areas adjacent to alpine and subalpine streams and meadows. This alliance was observed at Red Lake (one of the Virginia Lakes). Further sampling is required. One unclassified alliance-level sample was collected.

USGS-NPS Veg Data: 99K135 (alliance level only)

This alliance is known only from the Yosemite region (NatureServe 2007). *Arnica mollis* occurs from western Canada through the western cordillera of Washington and Montana to Colorado and California, including the Klamath Ranges, Cascade Range, Sierra Nevada, and White and Inyo mountains. Across most of that range, it is frequent in moist meadows at mid to high elevations; in Yosemite, it is uncommon but widespread (Botti 2001).

***Deschampsia caespitosa - Polygonum bistortoides* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Tufted Hairgrass - American Bistort Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Deschampsia caespitosa* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is known from the vicinity of Yosemite, Sequoia National Park (Benedict, 1983), and elsewhere in the Sierra Nevada (Ratliff, 1982, 1985).

**Yosemite and environs**
Stands of this association are found in mountain meadows throughout the mapping area from ecological Zone III up to ecological Zones V and VI. Stands have been sampled in the Akerson Meadow, Yosemite Falls, Tioga Pass, Tamarack Flat, Koib Peak, and Falls Ridge 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association occupies wet and moist meadows, streamsides, and lake margins in the montane and subalpine zone of the Sierra Nevada.

**Yosemite and environs**
Stands of this grassland association are found on gentle to moderate, lower and middle slopes. Elevations are between 6,000–10,500 feet, and aspects are all except north. Stands mostly occupy seasonally flooded to saturated, gently to moderately sloping low slopes and basins but some mid slope saturated meadows. Soils are seasonally flooded, mostly poorly drained sandy to silt loams and mucks derived from various parent materials.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Deschampsia caespitosa, Polygonum bistortoides, Senecio scorzonella, Solidago multiradiata*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Deschampsia caespitosa, Polygonum bistortoides*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This perennial bunchgrass vegetation is variable depending on the elevation. It usually forms a dense cover from 60–90 percent dominated by *Deschampsia caespitosa* (26.3% cover) with forbs including *Senecio scorzonella* (3% cover), *Solidago multiradiata* (7.5%), *Lupinus lepidus* (5% cover), *Achillea millefolium* (2.5% cover), *Oreostemma alpigenum* var. *alpigenum* (2.5% cover), *Polygonum bistortoides* (2.5% cover), *Trifolium monanthum* (2.5% cover), and *Potentilla drummondii* (2.5% cover). The most frequent graminoid associates include *Calamagrostis breweri* (2.5% cover), *Phleum alpinum* (2.5% cover), *Poa fendleriana* (2.5% cover), *Carex luzulifolia (*15% cover), *Trisetum wolfii* (0.5% cover), *Eleocharis quinqueflora* (1% cover), *Phleum alpinum* (0.4% cover), *Carex scopulorum* (1% cover), *Juncus mexicanus* (1% cover), *Muhlenbergia richardsonis* (0.7% cover), *Calamagrostis breweri* (0.7% cover), and/or *Trisetum spicatum* (0.7% cover). *Polygonum bistortoides* is the only species other than *Deschampsia* that occurs on all of the plots sampled.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Likely to be widespread, but of limited extent in the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS

**Globally**

Potter (pers. com. 2002) has 23 plots he characterizes as representing *Deschampsia cespitosa* alliance throughout the Sierra Nevada; these have not been split into associations. Only 13 have *Polygonum bistortoides*, suggesting further variation in this alliance outside of Yosemite.

**Yosemite and environs**

Note: As a result of the overlap between associations defined either from limited data or from elsewhere in the Sierra, the 13 samples collected representing this alliance were lumped into one grand association with *Polygonum bistortoides* as the main indicator species. The following previously defined associations have been at least temporarily subsumed for the Yosemite classification: Tufted hairgrass - Coville ragwort (*Deschampsia caespitosa - Senecio scorzonella*) association (Benedict, 1983) (n=4) 98M93, 98M82, 99K151, 99K173; Tufted hairgrass - Mountain goldenrod (*Deschampsia caespitosa - Solidago multiradiata*) association (Taylor, 1984) (n=1) 99K174; Tufted hairgrass (*Deschampsia caespitosa*) association (n=5) 99K107, 99K101, 99K139, 98M81, Potter 1650; Tufted hairgrass - Longstalk clover (*Deschampsia caespitosa - Trifolium longipes*) association (Ratliff, 1982, 1985) (n=1) 99S119; and Tufted hairgrass - Brewer bittercress (*Deschampsia caespitosa - Cardamine breweri)* association (Benedict, 1983) (n=2) 99S114, 99S118.

**Plots used to describe association (n=13)**

USGS–NPS Veg Data: 98M93, 98M82, 99K151, 99K173, 99K174, 99K107, 99K101, 99K139, 98M81, 99S114, 99S118, 99S119

Potter: 1650

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***Calamagrostis breweri - Vaccinium caespitosum* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Reedgrass - Dwarf Bilberry Herbaceous Vegetation** |
| **SYNONYM** | **Shorthair Reedgrass Series** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Calamagrostis breweri* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

Stands of this association have been described from the subalpine regions of the central Sierra Nevada near Yosemite. However, they are expected to occur elsewhere at least south to Sequoia and Kings Canyon national parks.

**Yosemite and environs**

This association has been sampled at several subalpine meadow sites near the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This subalpine and alpine sod grassland of California and Oregon occurs on meadows, flats, and gentle slopes from 4,200–12,500 feet elevation. Optimal habitats have subsurface moisture. The precipitation regime where this asociation occurs is strongly seasonal, with most precipitation falling in the winter months as snow. Summers are very dry. This association forms large stands, which often intergrade with other meadow, forest, and woodland types.

**Yosemite and environs**

Stands of this association occur on very gentle lower slopes and basin floors between 8,500–10,600 feet of elevation. Aspect is not important for the type as slopes seldom exceed 2 percent. Sites are seasonally saturated/flooded and usually have perennial subsurface moisture. Soils are loams and may contain very high amounts of organic material such as peat.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Calamagrostis breweri* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Calamagrostis breweri* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Calamagrostis breweri* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Calamagrostis breweri* |

VEGETATION DESCRIPTION

**Globally**
This alpine/subalpine meadow association contains *Calamagrostis breweri* as an important or dominant grass in the herbaceous layer, with other graminoids like *Danthonia intermedia* important canopy species. *Oreostemma alpigenum* (= *Aster alpigenus*) is the dominant forb, with the subshrub *Vaccinium caespitosum* present. Other associates may include *Carex* spp. *Gentiana newberryi, Ptilagrostis kingii, Achnatherum nelsonii, Lupinus lepidus, Potentilla* spp. *Trisetum spicatum,* and/or *Antennaria rosea.*

**Yosemite and environs**
Yosemite stands of this short alpine or subalpine sod grassland association are codominated by *Vaccinium caespitosum* (25% cover) and *Calamagrostis breweri* (24% cover). The forb *Oreostemma alpigenum* var. *alpigenum* (12% cover) is an important species. Other important forbs may include *Gentiana newberryi* (1% cover), *Castilleja newberryi* (1% cover), *Antennaria rosea* (2% cover), and the graminoids *Carex spectabilis* (1% cover) and/or *Danthonia intermedia* (3% cover). Traces of other forb and graminoid species are present.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION This association is generally common in many subalpine meadow systems throughout the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=13)**
USGS–NPS Veg Data: 98K81, 98K86, 98M117, 98M128
NRI: 161, 49, 67, 69, 152, 153, 154, 155, 156

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***Calamagrostis breweri - Oreostemma alpigenum* var. *alpigenum* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Reedgrass - Tundra Aster Herbaceous Vegetation** |
| **SYNONYM** | **Shorthair Reedgrass Series** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Calamagrostis breweri* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found on the eastern side of the Sierra Crest near Tenaya Lake, Tioga Pass, and Lee Vining Creek.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association occur on very gentle lower slopes and basin floors between 8,000–10,000 feet of elevation. Aspect is not important for the type as slopes seldom exceed 2 percent. Sites are seasonally saturated/flooded and usually have perennial subsurface moisture. Soils are sandy to silt loams. These meadows are typically covered by deep blankets of snow through most of the winter and spring.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis breweri, Oreostemma alpigenum* var. *alpigenum*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis breweri, Oreostemma alpigenum* var. *alpigenum*

VEGETATION DESCRIPTION
**Globally**
This alpine/subalpine meadow association contains *Calamagrostis breweri* as an important or dominant grass in the herbaceous layer, with other graminoids like *Danthonia intermedia* important canopy species. *Oreostemma alpigenum* (= *Aster alpigenus*) is the dominant forb, with the subshrub *Vaccinium caespitosum* present. Other associates may include *Carex* spp. *Polygonum bistortoides, Ptilagrostis kingii, Gentianopsis holopetala, Potentilla* spp. *Trisetum spicatum,* and/or *Antennaria* spp.

**Yosemite and environs**
This alpine/subalpine meadow association contains *Calamagrostis breweri* (33% cover) as the dominant grass in the herbaceous layer, with other graminoids like *Danthonia intermedia* (5% cover), *Carex exserta* (4.5% cover), *Carex fissuricola* (7% cover), and *Deschampsia caespitosa* (4% cover) important canopy species. Several other graminoids may be present at low cover values. *Oreostemma alpigenum* (= *Aster alpigenus*) is the dominant forb, with the subshrub *Vaccinium caespitosum* present but in low cover. Other forb associates may include *Gentianopsis holopetala* (0.4% cover), *Senecio scorzonella* (4% cover), *Polygonum bistortoides* (3.8% cover), *Ranunculus alismifolius* (0.75% cover), *Sibbaldia procumbens* (0.25% cover), *Ptilagrostis kingii* (= *Oryzopsis kingii*), *Muhlenbergia filiformis, Carex subnigricans* (2.5% cover), and/or *Antennaria* spp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
Potter (pers com 2002) has 19 plots throughout the subalpine Sierra Nevada with *Calamagrostis breweri* and *Oreostemma alpigenum,* but these have not been split further analyzed at the association level.

**Yosemite and environs**
This description includes the former shorthair reedgrass – gentian - alpine aster (*Calamagrostis breweri - Gentianella - Aster alpigenus*) association (Ratliff, 1982, 1985) described in the interim classification. Potter (2000 ms) describes a *Carex subnigricans - Oreostemma alpigenum* (= *Aster alpigenus*) association from the High Sierra, which resembles stands in this association that are strongly dominated by *Oreostemma*. With future sampling, it may become apparent that there is a *Carex subnigricans* association definable from the Yosemite region.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98K75, 98M76, 99K159, 99K167, 99K168

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***Calamagrostis breweri - Trisetum spicatum* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Reedgrass - Spike Trisetum Herbaceous Vegetation** |
| **SYNONYM** | **Shorthair Reedgrass Series** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Calamagrostis breweri* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association have been found in the vicinity of Tioga Pass.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association occur on basin floors to mid-slopes between 9,500–10,400 feet of elevation. Aspect does not seem to be important in differentiating this type. Slopes are gentle to moderate. Sites are temporarily saturated/flooded. Soils are sandy to silt loams. These stands are typically covered by a heavy blanket of snow throughout most of the winter and spring.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis breweri*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis breweri*, *Trisetum spicatum*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is heavily dominated by *Calamagrostis breweri* (50% cover), with *Trisetum spicatum* (5% cover) an important species. Other graminoids providing traces of cover include *Luzula congesta*, *Ptilagrostis kingii*, *Carex subnigricans*, and/or *Phleum alpinum.* Forbs provide up to about 10 percent cover, and the most common include *Potentilla drummondii* (0.5% cover), *Solidago multiradiata* (7.6% cover), *Castilleja lemmonii* (0.8% cover), *Oreostemma alpigenum* (0.8% cover), *Antennaria media* (4% cover), *Pedicularis groenlandica* (0.3% cover), *Penstemon heterodoxus* (0.3% cover), *Rumex paucifolius* (0.3% cover), and/or *Senecio scorzonella* (0.3% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association should be considered tentative due to the relatively small number of plots available. Further data are needed to substantiate its existence and its separation from the *Calamagrostis breweri- Oreostemma alpigenum* var. *alpigenum* association described previously.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99K119, 99K123, 99K146, 99S141
Potter (pers com. 2002): has 10 additional plots outside of study area

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***Calamagrostis canadensis* Herbaceous Vegetation** [Provisional]

**COMMON NAME** **Bluejoint Herbaceous Vegetation**
**SYNONYM** **Shorthair Reedgrass**

| | |
|---|---|
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Calamagrostis canadensis* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. Other associations of this alliance occur in the Colorado Rockies. The species is very widespread in northern North America.

**Yosemite and environs**

Stands of this association have been sampled in the mapping area at Half Dome, Tioga Meadows, Akerson Meadow, Tioga Pass, and Yosemite Falls 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association occur on flat to moderately sloping lower slopes along lakeshores, streams, and wet meadows ranging from 4,550–9,560 feet elevation. Aspect does not seem to be important in differentiating this type. Sites are seasonally saturated. Soils are poorly drained to somewhat poorly drained sandy loams, silty clay, and muck.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Calamagrostis canadensis*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Calamagrostis canadensis*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This dense palustrine grassland covers 80–90 percent of the surface on average and is usually strongly dominated by *Calamagrostis canadensis* (mean 53% cover), with *Polygonum bistortoides*, *Carex utriculata*, and *Senecio triangularis* commonly present in low cover. A large number of additional species are occasionally present in the stands and include *Lupinus latifolius, Caltha leptosepala, Carex vesicaria, Dodecatheon jeffreyi, Epilobium ciliatum, Glyceria striata*
*(= Glyceria elata), Aconitum columbianum, Lotus oblongifolius, Viola macloskeyi, Mimulus guttatus, Perideridia bolanderi, Sphenosciadium capitellatum, Thalictrum fendleri, Trifolium wormskioldii, Veratrum californicum, Ledum glandulosum, Mimulus primuloides, Symphyotrichum spathulatum* (= *Aster occidentalis), Allium validum, Carex abrupta, Carex mariposana, Carex spectabilis, Hordeum brachyantherum, Achillea millefolium, Lupinus burkei* ssp. *burkei, Viola adunca, Perideridia parishii, Salix lasiolepis, Solidago canadensis, Hypericum anagalloides, Penstemon rydbergii,* and *Phleum alpinum.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4S3?

RANK JUSTIFICATION Probably relatively widespread in the mountains of northern California and perhaps beyond, but of limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
There is a suggestion that an upper and a lower elevation association of this alliance exists locally. More plots are needed to substantiate this.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 99K111, 99S127, 99S138, 99S103, 99S109, 99S135

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***Ptilagrostis kingii* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Sierra False Needlegrass Herbaceous Vegetation** |
| **SYNONYM** | **Shorthair Reedgrass Series** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Ptilagrostis kingii* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is known from the glaciated highlands of the central and southern Sierra Nevada (Potter, 2000 ms).

**Yosemite and environs**
Stands of this association have been sampled in the mapping area at Falls Ridge, Tuolumne Meadows, and Tioga Pass 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is subalpine to alpine and ranges from 8,500–11,000 feet elevation. Sites are seasonally saturated meadows formed along permanent streams as stringer meadows. Some sites occur in basins. This type is often found along small first to second order streams. However, more frequently stands are some distance from streams in elevated portions of meadows. Surfaces may be hummocky or linear.

**Yosemite and environs**
Stands of this association occur on flat to moderately sloping lower slopes along lakeshores, streams and wet meadows ranging from 8,550–9,560 feet elevation. Aspect does not seem to be important in differentiating this type. Slopes are gentle to flat. Sites are seasonally saturated. Soils are moderately well drained to somewhat poorly drained loams and silt loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis canadensis*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Calamagrostis canadensis*

VEGETATION DESCRIPTION
**Globally**
This association averages a total vegetative cover of close to 100 percent. Trees are usually absent and shrubs are averaging less than 6 percent. The only shrub of any cover is the subshrub *Vaccinium caespitosum*. *Ptilagrostis kingii* is the dominant, averaging 60 percent cover, followed by *Carex subnigricans* (18%), *Danthonia intermedia* (8%), *Carex pachystachya* (9%), and *Luzula orestera* (5%). Forbs include *Antennaria* sp. (18%), *Oreostemma alpigenum* (15%), and several other species below 50 percent constancy.

**Yosemite and environs**
This dense palustrine grassland covers 80–90 percent of the surface on average and is usually strongly dominated by *Ptilagrostis kingii* (mean 70%). *Oreostemma alpigenum* is a constant at 5 percent, and *Polygonum bistortoides* averages 6 percent cover. *Calamagrostis breweri, Carex scopulorum* var. *bracteosa, Antennaria rosea, Gentiana newberryi, Castilleja lemmonii,* and *Trisetum spicatum*, among other species, contribute relatively low cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably relatively localized in the central and perhaps southern Sierra Nevada and of limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Although Sierra False Needlegrass herbaceous vegetation is generally found in association with *Calamagrostis breweri* and *Carex exserta* alliance stands, it has moister soil conditions than the latter and somewhat drier conditions than the previous alliance. Typically these are moderately wet stands compared to other meadow sites.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 98M103, 98M98, 98K109
NRI: 175
Potter: 1661, 1670
Potter (2000 ms): 10 plots outside of study area

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***DANTHONIA INTERMEDIA* HERBACEOUS ALLIANCE [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Timber Oatgrass Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Semi-natural |
| FORMATION | Short bunch temperate or subpolar grassland |

This alliance has been described only from Yosemite. It has been observed in Tuolumne Meadows. This alliance is represented by two associations, first defined from data in this project. In *Danthonia intermedia-Antennaria rosea* Herbaceous Vegetation, *Danthonia intermedia* co-occurs with *Antennaria rosea* in moist meadows. In *Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation, *Danthonia intermedia* occurs with other grasses in lower cover, including *Ptilagrostis kingii*, *Deschampsia caespitosa*, and *Calamagrostis breweri*. These stands are of moist alpine and subalpine meadows largely between 2400 and 3050 m. One association-level sample was collected for the undescribed *Danthonia intermedia-Ptilagrostis kingii* association.

USGS–NPS Veg Data: 98M88 (*Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation)

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***Danthonia intermedia - Antennaria rosea* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Timber Oatgrass - Rosy Pussy-toes Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Semi-natural |
| FORMATION | Short bunch temperate or subpolar grassland |
| ALLIANCE | Danthonia intermedia Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland to Palustrine |
| RANGE | |

**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Danthonia intermedia - Antennaria rosea* herbaceous vegetation were sampled in the mapping area of Yosemite and environs within the Dunderberg Peak, Vogelsang Peak and Tioga Pass 7.5 minute topographic quadrangles. Stands are likely found in portions of many subalpine meadow habitats throughout the park between 7,000 and 10,000 feet (Botti 2001).

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Danthonia intermedia - Antennaria rosea* herbaceous vegetation are found at mesic sites at high elevation (8,645–9,876 feet) on low slopes to basin floors of generally linear to mildly convex, gentle slopes. Exposures are variable ranging from northwest to south to east. These sites are often found on stream terraces and in meadows. Soils tend to be moderately well-drained to well-drained sandy loam to silt loam from granitic or metamorphic parent materials. Sites are seldom rocky with substrates dominated by relatively high cover of litter (10-50%) and bare soil (40-90%). Wood is scarce on these sites.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Herbaceous | *Danthonia intermedia, Antennaria rosea, Senecio scorzonella, Solidago multiradiata,* Potentilla gracilis |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| *Herbaceous* | Danthonia intermedia, Antennaria rosea, Muhlenbergia filiformis |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Danthonia intermedia - Antennaria rosea* herbaceous vegetation form a relatively dense herbaceous layer (70-90% herbaceous cover) consisting of a mix of herbaceous dicot and grass species. Shrub cover is sparse to nonexistent (0-20%); tree cover is typically present only in meadow-edge situations. *Danthonia intermedia* dominates stands with 37.5% mean cover. Other species providing significant cover include *Antennaria rosea* (15%), *Senecio scorzonella* (15%), *Solidago multiradiata* (15%), and *Potentilla gracilis* (15%). *Muhlenbergia filiformis* provides little cover (2.5%) but is a fairly consistent component. Other species with high frequency include *Calamagrostis breweri* (1.5%), *Perideridia parishii* (1.5%), and *Polygonum bistortoides* (0.5%). Other species with high frequency but low cover include *Trisetum spicatum* (0.5%). Additional species that may occasionally be found in these stands include *Fragaria virginia, Gentiana newberryi, Gentianopsis holopetala,*

*Ivesia lycopodioides* and *Phleum alpinum*. Stands typically have high species diversity as indicated by the 47 species found in just the three stands sampled.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION May be widespread in the Sierra Nevada, Cascade Range and elsewhere in northern California but little information available

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K87, 99S129, 99S132
Potter: 1659

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***Carex exserta - Cistanthe* spp. (*Carex filifolia* var. *erostrata - Calyptridium* spp. , Hickman 1993 nomenclature) Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Sedge – Pussypaws Species Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Carex (filifolia, exserta)* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite and from Rae Lakes in Kings Canyon National Park. It is expected throughout the subalpine zone of the central and southern Sierra Nevada. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association has been described from stands in Tuolumne Meadows.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association are known from seasonally flooded basin floor meadows at about 8,500 feet of elevation. Soils are well drained sands and sandy loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Carex exserta* (=*Carex filifolia* var. *erostrata*)

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Carex exserta* (=*Carex filifolia* var. *erostrata*), *Cistanthe (monosperma, umbellata)*(=*Calyptridium* [*monospermum, umbellatum*])

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This dry meadow grassland is heavily dominated by *Carex exserta* (=*Carex filifolia* var. *erostrata*) (19% cover), which forms a patchy canopy with other graminoids and forbs less than 0.5 meter in height. Associates are quite variable, but the forbs *Antennaria rosea* (0.5% cover) and a trace of at least one member of the genus *Cistanthe* (*monosperma, umbellata*) are usually present. Common graminoid associates providing traces of cover may include *Poa secunda, Achnatherum lemmonii, Agrostis variabilis,* and/or *Juncus parryi*. Most forb species are present only in traces, though *Lupinus breweri* (7.5% cover) may be locally common. Other forbs present in trace amounts may include *Oreostemma alpigenum* var. *alpigenum, Rumex paucifolius, Achillea millefolium, Gayophytum diffusum, Montia chamissoi, Penstemon rydbergii, Potentilla drummondii,* and/or *Streptanthus tortuosus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
This association is placed in the *Carex (filifolia, exserta)* Herbaceous Alliance. Kartesz recognizes *Carex exserta* and *Carex filifolia* as separate taxa, while The Jepson Manual (Hickman 1993) maintains *Carex exserta* as a variety, *Carex filifolia* var. *erostrata.*

**Yosemite and environs**
This description is based upon plot data collected in 1998. Burke's work was not used because of taxonomy differences.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 98M84, 98M101

***Carex exserta* (*Carex filifolia* var. *erostrata,* Hickman 1993) - *Trisetum spicatum* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Sedge – Spike Trisetum Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Carex exserta* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found at scattered locations in the alpine and subalpine regions east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this alpine and subalpine grassland are found between 8,700–11,500 feet of elevation on gentle to moderate slopes. Aspects are variable and do not seem to be diagnostic for this type. Stands are found on basin floors, lower to upper slopes. Soils are clay loams to silt loams derived from igneous or metamorphic parent materials.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous Carex exserta (=*Carex filifolia* var. *erostrata*), *Antennaria rosea*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Carex exserta* (=*Carex filifolia* var. *erostrata*), *Trisetum spicatum*

VEGETATION DESCRIPTION

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This subalpine to alpine meadow grassland is dominated by *Carex exserta* (=*Carex filifolia* var. *erostrata*) (20% cover) and *Trisetum spicatum* (5% cover). Associates are highly variable, but the most constant species are the forbs *Antennaria rosea* (4% cover) and *Solidago multiradiata* (4% cover). Graminoids, which provide traces of cover, may include *Danthonia intermedia, Poa secunda, Poa stebbinsii, Carex subnigricans, Carex breweri, Elymus elymoides,* and/or *Juncus patens.* Forb associates may include *Trifolium monanthum* (3% cover) and traces of *Antennaria media, Arenaria kingii, Castilleja nana, Eriogonum ovatum, Penstemon heterodoxus,* and/or *Potentilla drummondii.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
This association is placed in the *Carex* (*filifolia, exserta*) herbaceous alliance. Kartesz recognizes *Carex exserta* and *Carex filifolia* as separate taxa, while The Jepson Manual (Hickman 1993) maintains *Carex exserta* as a variety, *Carex filifolia* var. *erostrata.*

**Yosemite and environs**

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 99K134, 99S130, 99K149, 99K150
NRI: 237, 296
Potter (pers com 2002): has 3 additional plots outside study area

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***Carex exserta* (*Carex filifolia* var. *erostrata,* Hickman 1993) - *Penstemon heterodoxus* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Shorthair Sedge - Sierra Beardtongue Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Carex exserta* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |
| RANGE | |

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found near alpine lakes to the east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This alpine grassland prefers open, stony, dry habitats between 10,000–11,000 feet of elevation. Aspects are generally south and west. Stands often grow on the upper margins of meadows or just beyond the zone of seasonal soil saturation if the stand is adjacent to a lake. Soils are well drained sands or loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Carex exserta* (=*Carex filifolia* var. *erostrata)*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Carex exserta* (=*Carex filifolia* var. *erostrata*), *Penstemon heterodoxus*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this highly diverse and open alpine grassland occur on dry sites at the upper edges of meadows. Most stands occur as patches between rock outcrops or intergrade into *Pinus contorta* var. *murrayana* or *Pinus albicaulis* woodlands. *Carex exserta* (=*Carex filifolia* var. *erostrata*) dominates the stands with 20 percent cover. Ninety species have been recorded in stands of this association, though none contribute much cover. The forb *Penstemon heterodoxus* is diagnostic but only averages a trace of cover. Common graminoid associates include *Achnatherum nelsonii, Juncus parryi, Poa wheeleri, Poa stebbinsii, Trisetum spicatum,* and/or *Elymus elymoides.* Forb associates may include *Eriogonum incanum, Saxifraga aprica, Cistanthe umbellata, Gayophytum humile, Lupinus lepidus, Phlox diffusa, Phyllodoce breweri, Minuartia rubella,* and/or *Rumex paucifolius.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
This association is placed in the *Carex* (*filifolia*, *exserta*) herbaceous alliance. Kartesz recognizes *Carex exserta* and *Carex filifolia* as separate taxa, while Jepson maintains *Carex exserta* as a variety, *Carex filifolia* var. *erostrata.*

**Yosemite and environs**

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98K72, 98K77, 98K78, 99K120, 98K71, 98M77
NRI: 64, 78, 238
Potter: 1668

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***Carex nigricans* - *Kalmia polifolia* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Black Alpine Sedge - Bog Laurel Herbaceous Vegetation** |
| **SYNONYM** | **Blackish Sedge - Mountain Laurel Association (Taylor, 1984)** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Carex nigricans* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association may be widespread throughout the western United States. Similar stands have been documented in Washington, Oregon, and British Columbia (NatureServe, 2002).

**Yosemite and environs**
This association has been documented from the Gaylor Lakes Basin and the Harvey Monroe Hall Research Natural Area (Taylor, 1984) near Tioga Pass.

ENVIRONMENTAL DESCRIPTION
**Globally**
Vegetation within this association is found in moist subalpine and alpine meadows, snowbeds, lake margins, and other low-gradient depressions of the northern Rockies and Pacific ranges from 5,200–13,000 feet in elevation. These habitats are cold and snowy, with snowfields lingering into June or later. Soils are frigid, derived from bedrock or aggraded alluvium, usually high in organic matter, and strongly acidic. These communities are often associated with hummocky topography, which provides a juxtaposition of saturated and somewhat drained microhabitats. Water tables are often at or near the surface for much of the growing season, and organic decomposition is slow.

**Yosemite and environs**
This association is known from low-gradient basin floors and lake terraces at about 10,000 feet of elevation. Aspect is not diagnostic for this association. Soils are moderately well drained silt loams derived from igneous parent material.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Kalmia microphylla* |
| Herbaceous | *Carex* spp. |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Kalmia polifolia* |
| Herbaceous | *Carex exserta, Achnatherum lemmonii, Trichophorum clementis* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Kalmia microphylla* |
| Herbaceous | *Carex nigricans* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Kalmia polifolia* |
| Herbaceous | *Carex nigricans* |

VEGETATION DESCRIPTION

**Globally**

This association is typified by a dominant dwarf-shrub layer of *Kalmia microphylla*. Other ericaceous shrubs, including *Phyllodoce empetriformis, Phyllodoce breweri, Ledum glandulosum,* and *Vaccinium* spp., are common associates. Dwarf *Salix* spp. may also be present. The herbaceous layer is typically dominated by graminoids, of which Carices usually predominate. *Carex scopulorum* var. *bracteosa, Carex aquatilis, Carex canescens,* and *Carex pellita (= Carex lanuginosa*) are especially common. Grasses, such as *Deschampsia caespitosa, Danthonia intermedia,* and *Phleum alpinum,* may also be locally abundant. Mesic forbs are usually scattered through the graminoid matrix including *Symphyotrichum spathulatum* (= *Aster occidentalis*), *Pedicularis groenlandica, Caltha leptosepala, Gentiana* spp., *Dodecatheon* spp., and *Epilobium* spp.

**Yosemite and environs**

This association is typified by a dominant dwarf-shrub layer of *Kalmia polifolia* (37% cover). Other ericaceous shrubs, including *Phyllodoce breweri* (0.5% cover) and *Vaccinium caespitosum* (37% cover), are common associates. Dwarf *Salix* spp. like *Salix arctica* and *Salix orestera* may also be present in trace amounts. The herbaceous layer is typically dominated by graminoids, of which Carices usually predominate. *Carex exserta* (15% cover), *Carex spectabilis* (2.5% cover), and *Carex nigricans* (2.5% cover) are especially common. The forb layer is sparse but includes small amounts of *Oreostemma alpigenum* var. *alpigenum, Antennaria media, Botrychium simplex, Castilleja lemmonii, Lupinus lepidus, Potentilla drummondii,* and/or *Saxifraga aprica.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

This association may be better placed in the *Kalmia microphylla* saturated dwarf-shrubland alliance.

**Yosemite and environs**

**Plots used to describe association (n=1)**

USGS–NPS Veg Data: 98M124

## *Carex scopulorum* var. *bracteosa* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Rocky Mountain Sedge Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Carex scopulorum* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association is known from the vicinity of Yosemite and from Carson Pass (Major and Taylor, 1977).

**Yosemite and environs**

Stands of this association are found at scattered subalpine and alpine locations on both sides of the crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is confined to the wettest portions of meadow basins (Major and Taylor, 1977). There is evidence of cold water seepage, and the soil is a thick, organic, mineral-rich muck.

**Yosemite and environs**

This association is found in seasonally flooded basin floors and lower slopes, including tarn margins and low-gradient streamsides, between 6,800 and 10,500 feet of elevation. Slopes are flat to very gentle, and soils are poorly drained muck or silty loams with high organic content.

MOST ABUNDANT SPECIES

**Globally**

Herbaceous *Carex scopulorum* var. *bracteosa* (Major and Taylor, 1977)

**Yosemite and environs**

Herbaceous *Carex scopulorum* var. *bracteosa*

CHARACTERISTIC SPECIES

**Globally**

Herbaceous *Carex scopulorum* var. *bracteosa* (Major and Taylor, 1977)

**Yosemite and environs**

Herbaceous *Carex scopulorum* var. *bracteosa*

VEGETATION DESCRIPTION

**Globally**

*Carex scopulorum* var. *bracteosa* dominates this wet meadow type and has the highest constancy among sites (Major and Taylor, 1977). *Luzula comosa*, *Trichophorum clementis* (*Scirpus clementis* [Hickman, 1993]), *Arnica lanceolata* ssp. *prima* (*Arnica amplexicaulis* [Hickman, 1993]), and *Eriophorum crinigerum* (*E. criniger* [Hickman 1993]) may be present.

**Yosemite and environs**
This seasonally flooded perennial grassland is dominated by *Carex scopulorum* var. *bracteosa* (23.8% cover). The graminoids *Eleocharis quinqueflora* (6.1% cover), *Deschampsia cespitosa* (1.1%), *Carex aquatilis* (0.4%), *Carex utriculata* (0.8%), *Muhlenbergia filiformia* (0.8%) and traces of *Carex subnigricans* and *Agrostis humilis* may also be present. Common forb associates may include *Oreostemma alpigenum* var. *alpigenum* (= *Aster alpigenus*, 3.8% cover), *Mimulus primuloides* (1.1%), and *Polygonum bistortoides* (2.3%). *Dodecatheon alpinum*, *D. jeffreyi*, *Camassia quamash*, *Castilleja lemmonii*, *Kalmia polifolia*, and/or *Potentilla flabellifolia* may also be present. The shrub layer is sparse with only about 0.9 percent cover of *Salix planifolia* and only 0.5 percent cover of *Vaccinium uliginosum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
The *Carex scopulorum* var. *bracteosa* association includes two putative types previously considered: *Carex scopulorum-Eleocharis quinqueflora* Herbaceous Vegetation and *Carex scopulorum-Pedicularis groenlandica* Herbaceous Vegetation.

**Plots used to describe association (n=1)**
USGS–NPS Veg Data: 98M125, 98K73, 98K92, 98M66, 98K108, 99K142, 99K143, 99K147, 99S145, 99S148
Potter: 1010, 1012, 1013, 1562

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***Eleocharis quinqueflora* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Few-Flower Spikerush Herbaceous Vegetation** |
| **SYNONYM** | ***Eleocharis pauciflora* Herbaceous Vegetation** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| PHYSIOGNOMIC FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Eleocharis quinqueflora* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This vegetation type is found in the upper subalpine and lower alpine in the western United States (NatureServe, 2002).

**Yosemite and environs**
Stands of this association are scattered throughout the park.

ENVIRONMENTAL DESCRIPTION

**Globally**

This vegetation type forms uniform peatland communities and is found in the upper subalpine and lower alpine in the western United States. Sites can occur in wet basins, stream terraces, ponds, cirque basins, and marshy meadows associated with seeps. Soils are always organic and wet or saturated throughout the summer.

**Yosemite and environs**

This association is found on basin floors, meadows, lakeshores, and stream terraces from 6,900–10,000 feet of elevation.

MOST ABUNDANT SPECIES

**Globally**

Herbaceous *Eleocharis quinqueflora*

**Yosemite and environs**

Herbaceous *Eleocharis quinqueflora*

CHARACTERISTIC SPECIES

**Globally**

Herbaceous *Eleocharis quinqueflora*

**Yosemite and environs**

Herbaceous *Eleocharis quinqueflora*

VEGETATION DESCRIPTION

**Globally**

The vegetation is characterized by a moderately dense to dense herbaceous layer that is dominated by *Eleocharis quinqueflora*. Common graminoid associates may include *Carex scopulorum* or *Carex aquatilis*. Other graminoids can include *Carex buxbaumii, Carex utriculata, Deschampsia caespitosa*, and *Eleocharis rostellata*. Forb cover is low but can include *Caltha leptosepala, Pedicularis groenlandica, Oreostemma alpigenum (= Aster alpigenus), Dodecatheon alpinum*, and *Polygonum bistortoides*. Diagnostic of this herbaceous wetland alliance is the dominance or codominance of *Eleocharis quinqueflora* and the presence of surface water for extended periods during the growing season.

**Yosemite and environs**

This association is dominated by *Eleocharis quinqueflora* (33.5% cover) with *Oreostemma alpigenum* var. *alpigenum* (16.2% cover) an important species. Other common forb associates providing small amounts of cover may include *Polygonum bistortoides, Dodecatheon jeffreyi, Hypericum anagalloides*, and/or *Pedicularis attollens.* Many graminoids may be present at low cover and frequencies. The most common graminoid species include *Carex luzulifolia* (12.5% cover, 0.2 frequency), *Deschampsia caespitosa, Muhlenbergia filiformis*, and various other *Carex* and *Juncus* spp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4

RANK JUSTIFICATION

DATABASE CODE CEGL001836

COMMENTS

**Globally**

**Yosemite and environs**

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 98K76, 98K80, 99S113, 99S117, 99S120

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### *ISOETES* (*BOLANDERI, TENELLA, OCCIDENTALIS, NUTTALLII*) PERMANENTLY FLOODED HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **(Bolander's Quillwort, Spiny-spore Quillwort, Western Quillwort, Nuttall's Quillwort) Permanently Flooded Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Hydromorphic-rooted vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar hydromorphic rooted vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Permanently flooded temperate or subpolar hydromorphic-rooted vegetation |

This hydromorphic vegetation type of the western United States occurs in seasonal to permanent, freshwater wetlands in the mountainous areas of California and into southern Oregon and Baja California (NatureServe 2007). Water is still or slow-moving. This alliance occurs in stream and lake margins, in vernal pools, ponds, and marshes; species dominance is dependent on elevation and duration of inundation. Lower elevation stands with semi-permanent flooding are likely to be dominated by *Isoetes howellii* and/or *Isoetes orcuttii* (NatureServe2007). Montane lakes and ponds are likely to be dominated by *Isoetes bolanderi*, *Isoetes tenella* (= Isoetes echinospora), and/or *Isoetes occidentalis*. *Isoetes nuttallii* may occur along stream margins. Elevations vary from sea level to 1500 m (NatureServe 2007).

This alliance is represented locally by two associations. Neither was described due to an insufficient number of samples. However, Taylor (1984) described an association similar to the *Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation. The *Torreyochloa pallida* var. *pauciflora-Isoetes bolanderi* Herbaceous Vegetation of Taylor (1984) is from subalpine sites in the Hall Research Natural Area. Habitat of Taylor's association consisted of ponds with relatively deep water (up to 1.5 m or so) where wave action is minimal and cover, diversity and productivity is low. Associations dominated by *I. nuttallii*, *I. bolanderi* are expected to occur. This alliance has been observed at Lower Ottoway Lake, Benson Lake, and Pate Valley. Further sampling is required.

USGS-NPS Veg Data: 99S111, 99S115 (*Isoetes occidentalis* Herbaceous Vegetation);
98M115 (*Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation)

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### *Sparganium angustifolium* Herbaceous Vegetation [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Narrowleaf Bur-Reed Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Hydromorphic-rooted vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar hydromorphic rooted vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Permanently flooded temperate or subpolar hydromorphic-rooted vegetation |

| | |
|---|---|
| ALLIANCE | *Sparganium angustifolium* Permanently Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. It is likely that this species forms monospecific associations in many parts of montane and boreal North America.

**Yosemite and environs**

This wetland association occurs on the margins of montane and subalpine lakes and ponds throughout the park.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this permanently flooded vegetation are found rooted in shallow ponds and lakes between 7,800–10,000 feet of elevation. Slopes are flat and soils are seasonally inundated, poorly drained mucks.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Sparganium angustifolium*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Sparganium angustifolium*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this vegetation are characterized by a sparse cover of hydromorphic-rooted plants emerging less than 1 meter from the water. Total vegetative cover is generally less than 20 percent. *Sparganium angustifolium* (13.7% cover) is the dominant forb, sometimes forming pure stands or with only one or two associates. Common associates occurring in trace amounts may include *Callitriche heterophylla* ssp. *bolanderi*, *Potamogeton natans*, *Callitriche palustris (= Callitriche verna)*, *Carex spectabilis*, and/or *Utricularia macrorhiza (= Utricularia vulgaris).*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=5)**
**USGS–NPS Veg Data: 98M102, 98M97, 99K103, 99K140, 98M100**

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***PENSTEMON NEWBERRYI-STREPTANTHUS TORTUOSUS* HERBACEOUS ALLIANCE** (Taylor, 1984)

| | |
|---|---|
| **COMMON NAME** | **Mountain Pride - Shieldplant Herbaceous Alliance** |
| **SYNONYM** | ***Penstemon newberryi* Sparsely Vegetated Alliance** |
| PHYSIOGNOMIC CLASS | Sparse Vegetation |
| PHYSIOGNOMIC SUBCLASS | Consolidated rock sparse vegetation |
| PHYSIOGNOMIC GROUP | Sparsely vegetated pavement |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Pavement with sparse vascular vegetation |

This alliance is known only from Yosemite. It was originally described from the Hall Research Natural Area (Mono County, CA) and the Tioga Pass region by Taylor (1984). It occurs along fractures in granitic bedrock at moderate to high elevations (approximately 2600 to 3100 m). Vegetation cover and productivity are extremely low. A related association in the Pinus contorta var. murrayana alliance has the addition of sparse (2-10 percent) Sierra lodgepole pine cover. This alliance was observed at May Lake and Saddlebag Lake. Twelve samples were collected among the three associations listed by Taylor (1984).

USGS-NPS Veg Data: 98M79, 98K84, 98K100 (Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii Herbaceous Vegetation); 98M110, 98K98 (Spiraea splendens var. splendens [Spiraea densiflora, Hickman 1993]-Penstemon newberry-Streptanthus tortuosus Herbaceous Vegetation)
NRI Data: 244 (Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii Herbaceous Vegetation); 344, 302, 132, 305, 335 (Spiraea splendens var. splendens [Spiraea densiflora, Hickman 1993]-Penstemon newberry-Streptanthus tortuosus Herbaceous Vegetation); 341 (*Penstemon newberryi-Streptanthus tortuosus-Sedum obtusatum* ssp. *boreale-Muhlenbergia montana* Herbaceous Vegetation)

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*Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii* Herbaceous Vegetation [Provisional

| | |
|---|---|
| **COMMON NAME** | **Mountain Pride - Shieldplant/Watson's Spikemoss Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Sparse Vegetation |
| PHYSIOGNOMIC SUBCLASS | Consolidated rock sparse vegetation |
| PHYSIOGNOMIC GROUP | Sparsely vegetated pavement |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Pavement with sparse vascular vegetation |

| | |
|---|---|
| ALLIANCE | *Penstemon newberryi-Streptanthus tortuosus* Herbaceous Alliance [Provisional] |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from the Yosemite area. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii* herbaceous vegetation were sampled in the mapping area of Yosemite and environs within the Sing Peak, Tenaya Lake, and Tioga Pass 7.5 minute topographic quadrangles. It has been widely observed in open, granitic bedrock slabs and domes throughout Yosemite National Park.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii* herbaceous vegetation are found at xeric sites at high elevation (8,750–10,230 feet) on mid portions of linear to convex, gentle to moderately steep (12 - 23 degrees) slopes. Exposures are southerly, ranging from south to west. Stands are usually found on domes, bedrock outcrops and knobs. Soils are very poorly developed, well-drained to rapidly drained loamy sand from granitic parent materials. The amount of bedrock ranges from 2-50%, other rock cover adds an additional 13-45% cover, and leaf litter is almost negligible at 2-5% cover. Wood is scarce on these sites, and bare soil exposure is low at up to 16 percent.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Herbaceous | *Eriogonum nudum, Pellaea bridgesii, Selaginella watsonii* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Penstemon newberryi* |
| *Herbaceous* | *Streptanthus tortuosus, Selaginella watsonii, Elymus elymoides, Eriogonum nudum* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Penstemon newberryi-Streptanthus tortuosus/Selaginella watsonii* herbaceous vegetation typically form linear stands along fractures in bedrock. *Penstemon newberryi* forms an intermittent canopy over diminutive forms of common, dry-site herbs including *Streptanthus tortuosus* (1.8%), Elymus elymoides (1.8%), *Eriogonum nudum* (6%), *Sedum obtusatum* (2.5%), and *Pellaea bridgesii* (2.5%). *Selaginella watsonii* may dominate stands in terms of cover (6%). *Juncus parryi* provides little cover (0.5%) but is a consistent component. Other species that may be present include *Poa secunda*, *Triteleia ixioides*, *Achnatherum nelsonii*, *Cryptogramma acrostichoides*, *Spiraea splendens* [aka *S. densiflora*], *Pteryxia terebinthina var. terebinthina* and *Antennaria rosea*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread in the Sierra Nevada and elsewhere in northern California.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98M79, 98K84, 98K100
NRI: 244

SHRUB/SCRUB ASSOCIATIONS OF ECOLOGICAL ZONE IV:

***Artemisia tridentata* ssp. *vaseyana/Carex exserta* (*Carex filifolia* var. *erostrata, Hickman 1993*) Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Mountain Big Sagebrush/Shorthair Sedge Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural /Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association grows throughout the subalpine and lower alpine regions of the park and environs. Stands may occur on both the east and west side of the crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

*Artemisia tridentata* ssp. *vaseyana*-dominated shrublands occupy the coolest and moistest climate zone of the *Artemisia tridentata* shrubland complex. Associations often occur above the lower treeline as patches within montane or subalpine coniferous forests. The climate regime is cool, semiarid with yearly precipitation ranging from 25–60 centimeters. Much of the yearly precipitation falls as snow, which may cover the ground for long periods in winter. Temperatures are continental with large annual and diurnal variation.

**Yosemite and environs**

Stands of this association are found in the subalpine zone between 9,400–10,800 feet of elevation on basin floors and gentle to moderate lower slopes. Stands can occur on all aspects and prefer gentle slopes near meadow edges. The soils are moderate to deep silty loams. There may be a fair amount of stony, bare ground within stands.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *vaseyana* |
| Graminoid | *Carex exserta (=Carex filifolia* var. *erostrata)* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *vaseyana* |
| Graminoid | *Carex exserta (=Carex filifolia* var. *erostrata)* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This vegetation forms an intermittent to continuous canopy less than 0.5 meter in height. *Artemisia tridentata* ssp. *vaseyana* is the dominant shrub codominating with moist site indicator graminoids, primarily *Carex exserta (C. filifolia* var. *erostrata). Vaccinium caespitosum* (0.5% cover) may also be present in the shrub canopy. Other graminoids and forbs commonly present include *Antennaria rosea* (2% cover), *Achnatherum nelsonii* (2% cover), *Hesperostipa comata* (0.8% cover), *Lupinus leucophyllus* (0.8% cover), *Danthonia intermedia* (0.5% cover), *Juncus mexicanus* (0.5% cover), *Hesperostipa comata* (0.5% cover), and/or *Poa stebbinsii* (0.5% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: In the fieldwork for this project, some confusion existed in the identification of *Artemisia rothrockii* and *Artemisia tridentata* ssp. *vaseyana*. Thus, the descriptions for these two alliances are probably somewhat compromised. It appears that *Artemisia tridentata* ssp. *vaseyana* is more likely to be the most common subalpine/alpine sagebrush in the mapping area, while *Artemisia rothrockii* is restricted to the volcanics and metamorphics of the east side of the crest.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98M89
NRI: 35, 233

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***Spiraea splendens - Penstemon newberryi - Streptanthus tortuosus* Wooded Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Sierra Spirea – Mountain Pride – Shieldplant Wooded Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |

| | |
|---|---|
| ALLIANCE | *Penstemon newberryi - Streptanthus tortuosus* Wooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found at scattered alpine locations east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This sparse alpine association grows in cracks between granite slabs on poorly developed, sandy soils. Slopes are moderate to steep, and stands prefer mid to upper slope positions. Aspects are southeast to northwest.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Spiraea splendens* var. *splendens* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Spiraea splendens* var. *splendens* |
| Subshrub | *Penstemon newberryi* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This sparse alpine and subalpine vegetation grows in cracks of granitic slabs in rapidly drained soils. The canopy is open and between 0.5–1 meter in height. Emergent individuals of *Pinus contorta* var. *murrayana* may be present. Forb and graminoid species are highly variable, but *Spiraea splendens* var. *splendens* (2% cover) is generally present. The graminoid *Elymus elymoides* (2% cover) may be common in some stands. Other graminoid associates may include *Juncus parryi* (1% cover) and traces of *Agrostis variabilis* and/or *Carex rossii.* The diagnostic forb *Penstemon newberryi* is usually present in small amounts. Other forbs present at trace amounts may include *Sedum obtusatum*, *Perideridia parishii*, and/or *Selaginella watsonii.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
The position of this association within the USNVC should be evaluated.

**Yosemite and environs**

**Plots used to describe association (n=7)**
USGS–NPS Veg Data: 98M110, 98K98
NRI: 344, 302, 132, 305, 335
Taylor (1984) was also used

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***Salix eastwoodiae* Seasonally Flooded Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Eastwood's Willow Seasonally Flooded Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded cold deciduous shrubland |
| ALLIANCE | *Salix eastwoodiae* Seasonally Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is found in the upper montane, subalpine, and alpine locations, predominantly occurring throughout the central and southern Sierra Nevada. Stands are generally moderate to large in size for riparian, often covering several acres (Potter, 2000).

**Yosemite and environs**

Stands of *Salix eastwoodiae* seasonally flooded shrubland are sampled in the mapping area of Yosemite and environs within the Matterhorn Peak 15-minute, Tuolumne Meadows 15-minute, Hetch Hetchy Reservoir 15-minute, and Yosemite 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
Stands of *Salix eastwoodiae* seasonally flooded shrubland are found adjacent to or near streambanks in mesic to wet meadows at mid to high elevations (6,920–11,000 feet). Slopes are gentle to moderate (5–20%). They often appear in basins or as stringer meadows with streams present. These sites are at the bottom of broad to very broad valleys with moderate upland slopes and variable valley bottom gradients. This association is often found near first order

streams within the upper portions of mountain drainages. Slopes are usually convex in shape. Stands are formed on volcanic flows and glaciated granitic batholiths. The stands are seasonally to permanently saturated. Water typically is received by subsurface and overland flows from upstream slopes or upslope on a seasonal basis. Along streams, these stands can be seasonally flooded; however, the association does not appear to be significantly influenced by streamside disturbance (Potter, 2000).

**Yosemite and environs**
Stands of *Salix eastwoodiae* seasonally flooded shrubland are found at mid to high elevations (7,700–10,400 feet) on moderate to somewhat steep slopes (11–28 degrees) with variable aspects.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Salix eastwoodiae* (Potter, 2000) |
| Herbaceous | *Oreostemma alpigenum, Deschampsia caespitosa* (Potter, 2000) |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix eastwoodiae* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Salix eastwoodiae* (Potter, 2000) |
| Herbaceous | *Oreostemma alpigenum* var. *andersonii, Deschampsia caespitosa* (Potter, 2000) |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix eastwoodiae* |

VEGETATION DESCRIPTION
**Globally**
Stands of *Salix eastwoodiae* seasonally flooded shrubland form a two-story structure with a moderately open to intermittent low to moderately tall shrub layer dominated by *Salix eastwoodiae*. The understory herbaceous layer can be well developed with openings in the shrub layer occur. A variety of species found in the herbaceous layer includes *Oreostemma alpigenum (= Aster alpigenus), Mimulus primuloides, Polygonum bistortoides, Allium validum, Perideridia parishii, Deschampsia caespitosa, Carex scopulorum, Trisetum spicatum, Carex subnigricans, Phleum alpinum, Calamagrostis breweri,* and *Calamagrostis canadensis*. Moss is commonly found in this association (Potter, 2000).

**Yosemite and environs**
Stands of *Salix eastwoodiae* seasonally flooded shrubland form an open to continuous shrub layer dominated by *Salix eastwoodiae* and a well developed understory herbaceous layer. A variety of species are found in the herbaceous layer including *Allium validum, Thalictrum sparsiflorum, Phleum alpinum, Oreostemma alpigenum* var. *andersonii (= Aster alpigenus* var. *andersonii), Perideridia parishii, Deschampsia caespitosa, Trisetum spicatum, Dodecatheon jeffreyi,* and *Descurainia californica.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3G4? |
| RANK JUSTIFICATION | Numerous small stands probably occur through the High Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe this association (n=10)**
NRI: 33, 76, 32
Potter: 1035, 1007, 1509, 1719, 1028, 1004, 1646
Taylor (1984)

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***Salix orestera/Senecio triangularis* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Willow/Arrowleaf Groundsel Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous shrubland |
| ALLIANCE | *Salix orestera* Seasonally Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite and from the Carson Pass Area of the northern Sierra. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found near lakes in the subalpine regions of the environs, near the crest of the Sierra.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association grows on the uplands on the margins of subalpine lakes between 9,500–10,500 feet of elevation. Stands prefer gentle to moderate slopes with east to northeast aspects. Soils are seasonally saturated sands to silt loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix orestera* |
| Herbaceous | *Senecio triangularis* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix orestera* |
| Herbaceous | *Senecio triangularis* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This shrubland forms a canopy between 0.5–2 meters in height dominated by *Salix orestera* (50% cover) with minor cover provided by *Phyllodoce breweri* and *Vaccinium caespitosum.* The herbaceous understory is heavily dominated by the diagnostic species *Senecio triangularis* (19% cover), with significant amounts of *Senecio scorzonella* (7.7% cover). *Arnica mollis* occurs in some stands with up to 18 percent cover. Other common herbaceous associates may include *Antennaria media* (1.5% cover), *Castilleja lemmonii* (0.5% cover), *Pedicularis attollens* (0.5% cover), and/or *Potentilla drummondii* (7.5% cover). Several graminoids occur in small amounts, though some stands may contain up to 8 percent cover of *Ptilagrostis kingii*. Other graminoids, which occur at about 1 percent cover, may include *Carex spectabilis, Poa stebbinsii, Trisetum spicatum, Ptilagrostis kingii, Carex exserta,* and/or *Luzula subcongesta.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 98M116, 98M96
Potter: 1619

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***Salix orestera/Calamagrostis breweri* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Willow/Shorthair Reedgrass Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous shrubland |
| ALLIANCE | *Salix orestera* Seasonally Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found near Tioga Pass.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This palustrine association grows at about 10,000 feet of elevation on flat to gently sloping, seasonally flooded basin floors. Soils are silt loams derived from metamorphic parent material.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix orestera* |
| Herbaceous | *Antennaria rosea, Calamagrostis breweri* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix orestera* |
| Herbaceous | *Calamagrostis breweri* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is characterized by an open shrub canopy less than 0.5 meter in height dominated by *Salix orestera* (15% cover). Some stands are codominated by *Vaccinium caespitosum*, with some *Pinus contorta* (2.5%). The fairly dense herbaceous understory is dominated by graminoids, primarily *Calamagrostis breweri* (37.5% cover). Other graminoids may be present including *Carex fissuricola* (2.5% cover) and *Ptilagrostis kingii* (2.5% cover), and small amounts of *Juncus parryi, Poa secunda,* and/or *Trisetum spicatum.* Forbs present may include *Antennaria rosea* (15% cover) and *Senecio scorzonella* (2.5% cover), and traces of *Symphyotrichum spathulatum* var. *spathulatum (= Aster occidentalis* var. *occidentalis), Castilleja lemmonii, Chamerion angustifolium (= Epilobium angustifolium),* and/or *Lupinus lepidus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Potter's description of this association has less cover of *Vaccinium caespitosum* and *Pinus contorta.*

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99S159
Potter: 1563, 1620
Taylor (1984)

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***Salix planifolia*/*Carex scopulorum* Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Tea-leaf Willow /Rocky Mountain Sedge Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded cold deciduous shrubland |
| ALLIANCE | *Salix planifolia* Seasonally Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine (Seasonally Flooded) |

RANGE
**Globally**
This wetland association occurs in the alpine and upper subalpine zones in the southern and central Rocky Mountains from Colorado to northwestern Wyoming and eastern Washington. Stands primarily occur at low to middle alpine elevations, although they occur in the subalpine in western Colorado.

**Yosemite and environs**

One stand of *Salix planifolia*/*Carex scopulorum* shrubland was sampled in the mapping area of Yosemite and environs within a subalpine area of the Koip Peak 7.5-minute topographic quadrangle. Taylor (1984) has four samples from the high subalpine Hall Research Natural Area within the Tioga Pass 7.5-minute topographic quadrangle.

ENVIRONMENTAL DESCRIPTION
**Globally**
This community occupies diverse topographic positions, being found within and around seepage areas and drainages fed by persistent but melting snowfields and in headwaters of streams. Substrates are shallow to moderately deep, with high organic content, and range from loamy mineral to organic soils.

**Yosemite and environs**
Stands of *Salix planifolia*/*Carex scopulorum* shrubland are found along streams of varying size in subalpine and alpine meadows between approximately 2600 and 3200 m. These sites are seasonally flooded. Soils are typically poorly drained with textures ranging from silt loam to muck. Parent material can be metamorphic. Litter cover can be moderately high within this association (greater than 50%).

MOST ABUNDANT SPECIES
**Globally**
Shrub *Salix planifolia*

**Yosemite and environs**
Shrub *Salix planifolia*

CHARACTERISTIC SPECIES
**Globally**
Shrub *Salix planifolia*
Herbaceous *Carex scopulorum*

**Yosemite and environs**
Shrub *Salix planifolia*
Herbaceous *Carex scopulorum*

VEGETATION DESCRIPTION
**Globally**
Stands in this community are characterized by a low willow layer dominated by *Salix planifolia* with an average of 60% cover. *Carex scopulorum* var. *bracteosa* usually dominates the herbaceous understory with 25-50% cover. However, in some stands, *Caltha leptosepala* may codominate, the two species together averaging 30% cover. Associated understory species may include *Deschampsia caespitosa*, *Eleocharis quinqueflora*, *Juncus* spp., *Luzula spicata*, *Poa alpina*, and *Poa reflexa*, among the graminoids, and *Castilleja occidentalis*, *Gentiana algida*, *Geum rossii*, *Pedicularis groenlandica*, *Polygonum bistortoides*, *Potentilla diversifolia*, *Rhodiola rhodantha* (= *Sedum rhodanthum*), *Swertia perennis*, *Trifolium parryi*, and *Trollius laxus*, among the forbs.

**Yosemite and environs**
Stands of *Salix planifolia*/*Carex scopulorum* are characterized by dense, tall shrub canopies up to 2 meter in height and a tall herbaceous understory. This association has high species diversity and high productivity. *Salix planifolia* dominates the shrub layer; *Salix orestera* and/or *Salix eastwoodiae* may be present as well. *Carex scopulorum* has the highest constancy in the herbaceous layer. Other commonly occurring species include *Oreostemma alpigenum var. alpigenum*, *Thalictrum fendleri*, *Polygonum bistortoides*, *Senecio cymbalarioides*, *Trifolium monanthum*, and *Potentilla gracilis* var. *fastigiata*. *Veronica wormskjoldii* var. *alterniflora*, *Parnassia palustris*, *Senecio cymbalarioides*, *Carex subnigricans*, and *Agrostis thurberiana* may also occur.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K119
Potter (2000) had additional samples from the central and southern Sierra Nevada
Taylor (1984): 4 plots from the eastern portion of the mapping area

***Salix lemmonii* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Lemmon's Willow Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Seasonally flooded cold deciduous shrubland |
| ALLIANCE | *Salix lemmonii* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine (Semipermanently to Permanently Flooded) |

RANGE
**Globally**
Stands of *Salix lemmonii* shrubland are found in upper montane and subalpine locations throughout central and southern Sierra Nevada. They usually occur at moderate to large-sized stands but occasionally occupy streamside and lakeshore settings (Potter, 2000).

**Yosemite and environs**

Stands of *Salix lemmonii* shrubland are sampled in the mapping area of Yosemite and environs within the Mammoth Mountain and Tioga Pass 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
Stands of *Salix lemmonii* shrubland are found at mid to high elevations (6,200–9,000 feet) on gentle to somewhat steep slopes (4–47%) in meadows, on streambanks, along shores, and in seeps. Sites are often on bottoms of broad valleys with shallow upland slopes and occur in basins or as stringer meadows with streams present. They usually are adjacent to narrow first order streams indicative of upper portions of drainages. Microrelief is uniform and gently undulating. Meadows seasonally receive water by subsurface and overland flows from upstream of upslope sources. Some sites are semipermanently flooded, but most are dry at the surface in the summer. Streamside stands are seasonally or intermittently flooded, but stands within seeps are permanently saturated. This association does not appear to be significantly influenced by streamside disturbance. Soils are formed from granitic parent material deposited as alluvium in valley floors. They are often deep but less than 40 inches deep. Surface textures are loams and clays and subsurface textures are sandy clay loams. Drainage is poor to somewhat poor (Potter, 2000).

**Yosemite and environs**
Stands of *Salix lemmonii* shrubland are found on gentle to steep, south- to southwest-facing slopes in basin floors, channel beds, and drainages. These sites are semipermanently to permanently flooded. Soils are poorly drained to very poorly drained with textures ranging from silt loam to muck. Parent material can be metamorphic or granitic. Litter cover can be high (65–70%) within this association.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Salix lemmonii* (Potter, 2000) |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix lemmonii* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Salix lemmonii* (Potter, 2000) |
| Herbaceous | *Mimulus guttatus* (Potter, 2000) |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix lemmonii* |

VEGETATION DESCRIPTION
**Globally**
Stands of *Salix lemmonii* shrubland form a dense, moderately tall shrubland dominated by *Salix lemmonii.* Most associates in this stand are obligate and facultative wetland species. Understory species vary, but there is a high constancy of *Carex utriculata.* Other common species include *Mimulus guttatus, Perideridia parishii, Senecio triangularis, Lupinus latifolius, Oreostemma alpigenum (= Aster alpigenus), Veratrum californicum, Achillea millefolium, Stachys albens, Viola macloskeyi,* and *Glyceria striata (= Glyceria elata).* This association is often adjacent to *Pinus contorta, Abies magnifica,* and *Pinus jeffreyi* forest alliance stands (Potter, 2000).

**Yosemite and environs**
Stands of *Salix lemmonii* shrubland form an open three-story structure with an intermittent to continuous shrub layer and an open herbaceous layer. Emergent *Pinus contorta* may be present at 5–10 meters tall. The shrub layer is structured mostly 1–2 meters tall, and averages about 45 percent cover. This layer, dominated by *Salix lemmonii,* characterizes the association. The herb layer ranges from 5–30 percent at 0.5–1 meter tall. It commonly includes *Phleum alpinum, Potentilla gracilis, Allium validum, Epilobium ciliatum, Juncus drummondii, Polygonum bistortoides, Thalictrum fendleri,* and *Veronica wormskjoldii. Carex amplectens, Calamagrostis canadensis, Carex utriculata, Perideridia parishii,* and *Poa pratensis* are occasional. Other species contributing to minor cover may include *Aconitum columbianum, Arnica mollis, Symphyotrichum foliaceum* var. *apricum (= Aster foliaceus* var. *apricus), Carex heteroneura* var. *heteroneura, Lupinus polyphyllus, Mimulus guttatus,* mosses, *Platanthera leucostachya, Senecio triangularis,* and *Trifolium monanthum.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98M108, 99K124, 99S142
Potter (2000) 21 plots outside study area.

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***Salix melanopsis* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Dusky Willow Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |

| | |
|---|---|
| FORMATION | Seasonally flooded cold deciduous shrubland |
| ALLIANCE | *Salix melanopsis* Seasonally Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. The species occurs throughout much of the western United States and is likely to form stands elsewhere in its range.

**Yosemite and environs**

Stands of *Salix melanopsis* shrubland are found throughout the mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Salix melanopsis* shrubland are found at high elevations (approximately 9,900 feet).

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix melanopsis* |

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix melanopsis* |

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Salix melanopsis* shrubland are dominated by *Salix melanopsis.* Other species that may be present include *Salix eastwoodiae, Allium validum, Symphyotrichum spathulatum* var. *spathulatum (= Aster occidentalis* var. *occidentalis), Salix planifolia* ssp. *planifolia, Lupinus burkei* ssp. *burkei (= Lupinus polyphyllus* var. *burkei), Hordeum brachyantherum,* and *Descurainia californica.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association requires further substantiation within the sudy area.

**Plots used to describe association (n=3)**
Potter: 1568, 1566, 1567

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***Holodiscus discolor/Sedum obtusatum* ssp. *boreale* - *Cryptogramma acrostichoides* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Oceanspray/Sierra Stonecrop - American Rockbrake Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate cold deciduous shrubland |
| ALLIANCE | *Holodiscus discolor* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found in scattered locations in the subalpine regions of the park east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found on steep midslopes between 8,200–10,000 feet. Aspects are east to south, and soils are silt loams to loamy sands derived from metamorphic or igneous parent material.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Holodiscus discolor* |
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Holodiscus discolor* |
| Herbaceous | *Sedum obtusatum* ssp. *boreale, Cryptogramma acrostichoides* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association forms an intermittent canopy between 0.5–5 meter in height. *Holodiscus discolor* (15% cover) dominates the shrub canopy with small amounts of *Leptodactylon pungens, Artemisia tridentata,* and/or *Artemisia rothrockii* usually present. *Cryptogramma acrostichoides* and *Sedum obtusatum* are the diagnostic herbaceous species, though neither contributes more than 1.5 percent cover. Other common herbaceous species present at very low cover values may include *Eriogonum nudum, Castilleja applegatei, Pellaea bridgesii, Penstemon newberryi, Achillea millefolium,* and/or *Streptanthus tortuosus.* Several graminoid species provide traces of cover including *Elymus elymoides, Achnatherum occidentale, Agrostis variabilis,* and/or *Juncus parryi*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

Note: The taxon *Holodiscus discolor* has been treated taxonomically in various ways. The high mountain forms such as those included herein were once called *Holodiscus microphyllus*. These taxa have been recently subsumed into synonymy with *Holodiscus discolor,* which now includes low elevation coastal, midmontane, and subalpine to alpine forms.

**Plots used to describe association (n=4)**

USGS–NPS Veg Data: 99K109, 99K172, 99S161, 98K99

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***Vaccinium caespitosum/Carex exserta (C. filifolia* var. *erostrata,* Hickman 1993) Dwarf-Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Dwarf Bilberry/Shorthair Sedge Dwarf-Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |

| | |
|---|---|
| PHYSIOGNOMIC SUBCLASS | Deciduous dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Caespitose cold deciduous dwarf-shrubland |
| ALLIANCE | *Vaccinium (caespitosum, scoparium)* Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Vaccinium caespitosum/Carex exserta* dwarf-shrubland are found at higher elevations in the mapping area of Yosemite and environs and were sampled within the Tioga Pass 7.5-minute topographic quadrangle and Tuolumne Meadows 15-minute topographic quadrangles. These stands are often in association with *Pinus contorta* var. *murrayana* mesic associations.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Vaccinium caespitosum/Carex exserta* dwarf-shrubland are found at high elevations (9,100–9,900 feet) on moist sites. This association is found on soils with textures ranging from loam to silt loam. Soils are moderately well drained to somewhat poorly drained. Litter cover can be high (58–80% cover). Slopes are typically gentle and aspect is variable.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Carex exserta (C filifolia* var. *erostrata*) |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium caespitosum* |
| Herbaceous | *Carex exserta (C filifolia* var. *erostrata*) |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Vaccinium caespitosum/Carex exserta* dwarf-shrubland form an intermittent shrub layer dominated by *Vaccinium caespitosum* and an open herb layer characterized by *Carex exserta*. *Antennaria rosea, Solidago multiradiata, Castilleja lemmonii,* and *Oreostemma alpigenum* var. *alpigenum,* are often present but contribute to minor cover. A variety of other species are occasionally found contributing to minor cover in this association including *Poa stebbinsii, Calamagrostis breweri, Botrychium simplex, Carex rossii, Danthonia intermedia, Danthonia unispicata, Luzula congesta, Pedicularis attollens, Ptilagrostis kingii,* and *Saxifraga aprica.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: This association is tentative and is clearly related to the *Carex* (*filifolia, exserta*) herbaceous alliance and the *Calamagrostis breweri* alliance. It is distinguished by its strong dominance by *Vaccinium caespitosum.*

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98M99, 99K148
Potter: 1669, 1648

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***Vaccinium uliginosum* Dwarf-Shrubland**

| | |
|---|---|
| **COMMON NAME** | **Bog Blueberry Dwarf-shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Saturated cold deciduous dwarf-shrubland |
| ALLIANCE | *Vaccinium uliginosum* Saturated Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. It is likely to range throughout the Sierra Nevada. Similar if not identical stands have been seen in the northern Sierra Nevada in Bucks Lake Wilderness and in the subalpine zone of Kings Canyon National Park (Charlotte Lake area).

**Yosemite and environs**

Stands of *Vaccinium uliginosum* dwarf-shrubland are sampled in the mapping area of Yosemite and environs within the Yosemite, Hetch Hetchy Reservoir, and Tuolumne Meadows 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Vaccinium uliginosum* dwarf-shrubland are found at midelevations (6,900–8,100 feet). They occur in saturated to seasonally wet meadows and streamsides usually on gently sloping to relatively flat terrain. Microrelief is often hummocky.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium uliginosum* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Vaccinium uliginosum* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Vaccinium uliginosum* dwarf-shrubland are dominated by *Vaccinium uliginosum*. *Pinus contorta* and *Abies magnifica* may be occasionally found in the overstory. The shrub layer of *Vaccinium uliginosum* is diagnostic. Other shrubs are less abundant and may include *Ledum glandulosum*, *Salix planifolia* ssp. *planifolia*, and *Salix lemmonii*. Herbaceous species include *Oxypolis occidentalis*, *Polygonum bistortoides*, *Perideridia bacigalupii*, *Phalacroseris bolanderi*, *Mimulus primuloides*, *Agrostis idahoensis*, *Carex rossii*, *Carex nudata*, *Juncus macrandrus*, *Juncus nevadensis*, and *Juncus drummondii*. Moss (*Sphagnum* spp.) is often present at this association.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G2G3? |
| RANK JUSTIFICATION | Tends to occupy meadows that have not had any heavy grazing and restricted to saturated, relatively flat settings. These combined situations are now relatively rare in the Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**
This association prefers the margins of wet meadows in the Zones III and IV. It often is associated with high cover of *Sphagnum* spp.

**Plots used to describe association (n=3)**
Potter: 1610, 1034, 1721

FORESTS AND WOODLANDS OF ECOLOGICAL ZONE IV

## PINUS CONTORTA FOREST ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine Forest Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |

This alliance is found in the upper montane and subalpine zone of most major mountain ranges of the western U.S., as well as the Oregon and northern California coasts. It includes the four varieties of *Pinus contorta* currently recognized by taxonomists. At Yosemite, this alliance is represented by stands of *Pinus contorta* var. *murrayana* which occur at high elevations (2200 - 3050) on a wide variety of sites. Soils are derived from granitic and metamorphic parent material. They may be poorly drained to well drained loams on stream terraces, basin floors, moraines, and slopes. Slope exposure, slope steepness, and slope position are variable.

This alliance is dominated by *Pinus contorta* var. *murrayana*. Other tree species that may be important include *Pinus albicaulis*. The *Pinus contorta* Forest Alliance is derived from a series concept in which associations are distinguished by the dominance of *Pinus contorta* in the tree canopy and the near total lack of regeneration of other conifers (NatureServe 2007). Stands dominated by *Pinus contorta* but with significant regeneration of other tree species, such as *Abies magnifica*, *Pinus monticola*, *Tsuga mertensiana*, and *Populus tremuloides* have been placed into associations named for those species. There may be associations with those species appropriately placed in *Pinus contorta* Forest Alliance, but which have been classified as belonging to other series due to lack of *Pinus contorta* reproduction or due to lack of data. Important shrub species may include *Ribes montigenum*, *Vaccinium uliginosum*, *Ledum glandulosum*, *Penstemon newberryi* and *Artemisia tridentata*. The herbaceous layer may be sparse or abundant and may include mesophytic species such as *Ligustum grayi*, *Thalictrum fendleri*, *Carex rossii*, and *Calamagrostis canadensis* or xerophytic species such as *Arabis platysperma*, *Carex exserta* (=*Carex filifolia* var. *erostrata*), *Poa wheeleri*, *Achnatherum occidentale*, and *Juncus parryi*.

This alliance is represented locally by 11 associations, four defined by Potter (1998), two by Taylor (1984), and five newly defined with data from this project. It has been observed at Lake Vernon, White Wolf, Yosemite Creek Campground, Tuolumne Meadows, and along the Saddlebag Lake Road.

### *Pinus contorta* var. *murrayana* Forest

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |

USFWS WETLAND SYSTEM Upland

RANGE

**Globally**

This association is widespread at higher elevations of the Sierra Nevada. This association is found at the highest elevations of the upper montane, often sharing this position with *Abies magnifica - Pinus monticola - Pinus contorta* var. *murrayana* forest. Together, they straddle the Sierra Nevada Crest at higher elevations. Stands can cover extensive areas, but most are less than 100 acres due to natural fragmentation of the landscape.

**Yosemite and environs**

This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

Elevations are mostly above 8,500 feet and aspects are variable. Slopes range from gentle to somewhat steep but are predominantly moderate or gentle. The association typically occurs on the lower portions of slopes or on benches. Soils are derived from igneous rocks, primarily granite, but also pumice, rhyolite, and andesite, and have sandy loam or gravelly loam textures. Soils are typically well drained but may be excessively drained. Sites are characterized by significantly higher levels of surface gravel as compared to other associations in the upper montane of the Sierra Nevada. Litter cover is also generally high.

**Yosemite and environs**

In Yosemite and environs, this association occurs between 7,100–10,300 feet. Aspects are variable, though primarily western, southwestern, and southern, and slopes are gentle to somewhat steep. Soils are derived from granite and range from sandy loam to gravelly sand.

MOST ABUNDANT SPECIES

**Globally**

Tree *Pinus contorta* var. *murrayana*

**Yosemite and environs**

Tree *Pinus contorta* var. *murrayana*

CHARACTERISTIC SPECIES

**Globally**

Tree *Pinus contorta* var. *murrayana*

**Yosemite and environs**

Tree *Pinus contorta* var. *murrayana*

VEGETATION DESCRIPTION

**Globally**

Stands of this association are moderately dense forests with open understories. Tree cover is moderate, averaging 59 percent cover. Tree overstories are dominated by *Pinus contorta* var. *murrayana* with very scattered *Abies magnifica*. *Pinus monticola* is a rare member of the stand. The shrub layer is essentially absent, averaging less than 1 percent, although *Ribes montigenum* occurs in widely scattered locations indicating moist conditions. Cover of herbaceous dicots is among the lowest in the upper montane associations, averaging 3 percent; the species represent a mix of moderate to dry conditions (e.g., *Arabis platysperma* indicating drier sites and *Pyrola picta* and *Thalictrum fendleri* indicating moister sites). Herbaceous monocots average 10 percent cover, with *Carex rossii* indicating moister conditions and *Achnatherum occidentale* indicating drier conditions. Conifer regeneration is moderate, dominated by *Pinus contorta* var. *murrayana*, with generally more than 250 seedlings per acre.

**Yosemite and environs**

In Yosemite and environs, tree cover averages approximately 60 percent (31–72%), almost completely composed of *Pinus contorta* var. *murrayana*, with very scattered *Abies magnifica* and *Tsuga mertensiana*. As with the global

range, the shrub cover is essentially absent and the herb layer generally less than 10 percent cover and composed of variable species.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION This is probably a widespread type covering many thousands of acres in the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS

**Globally**

Note that the national classification would tend to call this and other forests with open and uncharacteristic understory as "sparsely vegetated" understories. The formal name for this association will probably be *P. contorta* var. *murrayana*/ sparse understory forest (M. Reid pers com 2002).

**Yosemite and environs**

Probably the most extensive of the Sierra lodgepole pine forests in the Sierra Nevada.

**Plots used to describe association (n=29)**

USGS–NPS Veg Data: 98MCHS1
NRI: 289, 60, 112
Wieslander: **560, 528, 532, 514, 516, 462, 465, 344, 360, 382, 317, 330, 241, 249, 254, 261, 236, 237, 238, 239, 169, 111, 25, 27, 366**
Potter (1998) 8 plots outside of study area

***Pinus contorta* var. *murrayana/Ligusticum grayi* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Gray's Licorice-root Forest** |
| **SYNONYM** | **Lodgepole Pine/Gray's Lovage Association (Potter 1998) and *P. contorta/Thalictrum fendleri* (Taylor, 1984) in part** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
*Pinus contorta/Ligusticum grayi* forest has a wide distribution in the Sierra Nevada (Potter, 1998).

**Yosemite and environs**
Stands of *Pinus contorta/Ligusticum grayi* forest are found at higher elevations on both slopes of the range and were sampled within the Matterhorn Peak and Hetch Hetchy Reservoir 15-minute topopgraphic quadrangles and in the Sing Peak and Tiltill Mountain 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
*Pinus contorta/Ligusticum grayi* forest is found at high elevations (6,660–8,920 feet) on low slopes and benches. Aspect is variable but often northwestern and northeastern. This association is found on gentle to somewhat steep (3–32%) slopes. The microtopography tends to be hummocky and broken. Soils are poorly drained to well drained with textures ranging from sandy loam to sandy clay loam derived from granitic parent material. Soil depths are moderately deep to deep (22 to greater than 40 inches). Bare soil, gravel, and rock cover tend to be minimal (0–4%, 0–6%, and 0–25% cover, respectively) (Potter, 1998).

**Yosemite and environs**
Stands of *Pinus contorta/Ligusticum grayi* forest are found at mid to high elevations (6,100–9,300 feet). Aspect is variable; however, it tends to be south, west, and southeast. This association is found on flat to somewhat steep (0–18 degrees) slopes. Soils are generally loamy and range from sandy, gravelly loam, to loam. Parent material is granitic. Soils are well drained to moderately well drained with depths that are moderately deep to deep. These sites usually experience low levels of disturbance. Evidence of fire was common in the sampled stands.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus contorta, Abies magnifica* (Potter 1998) |
| Shrub | *Ribes montigenum* (Potter 1998) |

**Yosemite and environs**

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus contorta, Abies magnifica* (Potter 1998) |
| Herbaceous | *Ligusticum grayi* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* |
| Herbaceous | *Ligusticum grayi* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Pinus contorta/Ligusticum grayi* forest form a continuous forest dominated by *Pinus contorta*, but *Abies magnifica* is often present. The dense understory is typically continuous with the occasional *Ribes montigenum* and *Ribes roezlii (= Grossularia roezlii)* in the shrub layer. The lush herbaceous layer typically is composed of *Ligusticum grayi, Orthilia secunda, Perideridia parishii, Senecio triangularis, Osmorhiza berteroi (= Osmorhiza chilensis), Veratrum californicum, Poa bolanderi,* and *Luzula comosa* (Potter, 1998).

**Yosemite and environs**

Stands of *Pinus contorta/Ligusticum grayi* forest form a dense forest dominated by *Pinus contorta*, but *Abies magnifica* is often important in the overstory. Rarely are *Abies concolor, Populus tremuloides,* and *Pinus jeffreyi* present in the tree layer. The understory is usually densely covered with a large variety of herbs, which may include *Carex* sp., *Juncus* sp., *Senecio triangularis, Veratrum californicum, Thalictrum fendleri, Polygonum bistortoides (= Bistorta bistortoides),* and *Poa wheeleri.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION Probably widespread mesic association of the *Pinus contorta* alliance in California.

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

This type includes the Taylor (1984) *Pinus contorta/Thalictrum fendleri* association (identified in the interim classification), as this appears to be a more synoptic view of the association with a wider area sampled.

**Plots used to describe association (n=25)**

NRI: 189, 258, 11, 101, 190, 192, 193, 196, 340, 336, 109, 9, 108
Wieslander: **79, 171, 155, 124, 119, 121, 8, 11, 162, 195, 708, 736**
Potter (1998) 23 plots outside of study area

---

***Pinus contorta* var. *murrayana* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine Woodland** |
| **SYNONYM** | **Lodgepole Pine/Woodlands (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus contorta* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

Stands of *Pinus contorta* woodland are found throughout the central and southern Sierra Nevada (Potter, 1998).

**Yosemite and environs**

Stands of *Pinus contorta* woodland are sampled in the mapping area of Yosemite and environs within the Sing Peak 7.5-minute and Matterhorn Peak, Tuolumne Meadow, and Merced Peak 15-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Pinus contorta* woodland are found at mid to upper elevations (7,400–9,000 feet) on all aspects. This association is found on gentle to moderate slopes that are 5–30 percent. This association is often on lower slopes and benches; however, a high portion is also on broad somewhat rounded ridge tops and a few occur on midslopes. Bare ground and surface gravel are higher at this association and litter cover is lower compared to other nearby associations. Microrelief is usually uniformly smooth; however, sites are occasionally hummocky due to large surface rocks. Soils are typically sandy and derived from granite; however, these soils are formed from pumice cinders and ash near Mammoth Mountain. Soil depths are between 25 and 35 inches. Coarse fragments are relatively low, and drainage is usually excessive (Potter, 1998).

**Yosemite and environs**

The *Pinus contorta* woodland is found at mid to high elevations (8,100–10,000 feet) on gentle to steep slopes (0–27 degrees). Aspect varies from southeast to northwest but is often east, southwest, or west. These sites are usually stony (72–85% rock cover) with soil textures that range from stony to loamy. Soils are well drained to moderately well drained, and soil depths are shallow to deep. Parent material is granitic. Fire is uncommon and disturbance tends to be low at these sites.

MOST ABUNDANT SPECIES

**Globally**

Tree *Pinus contorta* var. *murrayana, Abies magnifica* (Potter, 1998)

**Yosemite and environs**

Tree *Pinus contorta* var. *murrayana*

CHARACTERISTIC SPECIES

**Globally**

Tree *Pinus contorta* var. *murrayana, Abies magnifica* (Potter, 1998)

**Yosemite and environs**

Tree *Pinus contorta* var. *murrayana*

VEGETATION DESCRIPTION

**Globally**

Stands of *Pinus contorta* var. *murrayana* woodland are open woodlands with a scattered understory of herbs. Tree cover is scattered and in patches. The overstory is characterized by open *Pinus contorta* usually with scattered *Abies magnifica*. The shrub layer is essentially missing or occurs at very low levels. The herbaceous layer is composed of *Cistanthe umbellata* var. *caudicifera (= Calyptridium umbellatum* var. *caudiciferum), Pedicularis semibarbata, Arabis platysperma, Eriogonum nudum, Gayophytum eriospermum, Elymus elymoides* ssp. *californicus,* and *Achnatherum occidentale* ssp. *californicum*. Regeneration is dominated by *Abies magnifica;* however, *Pinus contorta* is also present (Potter, 1998).

**Yosemite and environs**

*Pinus contorta* var. *murrayana* woodland is characterized by an open to intermittent overstory tree layer dominated by *Pinus contorta*. Occasionally, *Abies magnifica* and *Pinus monticola* will contribute minor overstory cover. *Arctostaphylos nevadensis* and *Quercus vaccinifolia* are occasionally in the open understory shrub layer. The herb layer is often sparse and may include *Juncus parryi, Penstemon newberryi, Achnatherum occidentale* ssp.

*occidentale, Carex rossii, Carex exserta (= Carex filifolia* var. *erostrata), Poa secunda, Calochortus leichtlinii, Holodiscus discolor, Phyllodoce breweri, Ribes* sp., *Ribes montigenum, Phlox diffusa, Sedum obtusatum,* and *Eucephalus breweri (= Aster breweri).*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION Probably a common type of open subalpine woodland in the central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**
In the national classification, the sparse understory component would be identified as a character of the name and thus the formal name might be *Pinus contorta* var. *murrayana*/sparse understory woodland.

**Yosemite and environs**
Note: In NRI data, this is a heterogeneous lot with some fitting into Potter's (1994) *Pinus contorta* woodland association. Also note that this is less than 60 percent tree cover on average and would fall into a *Pinus contorta* woodland alliance in the USNVC. Currently, this association is easily differentiated from the other open woodland in the study area, *P. contorta* var. *murrayana/Carex exserta (C. filifolia* var. *erostrata*), by the lack of significant understory of *C. exserta* and the typical presence of *Abies concolor* in at least the reproduction layer.

**Plots used to describe association (n=22)**
NRI: 252, 185, 199, 253, 165, 360, 182
Wieslander: **594, 533, 534, 522, 524, 398, 399, 400, 408, 334, 271, 272, 277, 103, 94**

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***Pinus contorta* var. *murrayana/Penstemon newberryi* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Mountain Pride Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is a sparsely wooded version of *Penstemon newberryi - Streptanthus tortuosus* alliance that is also known from the Harvey Monroe Hall Research Natural Area, Inyo National Forest, California (Taylor, 1984).

**Yosemite and environs**
Stands of *Pinus contorta/Penstemon newberryi* woodland are found in Ecological Zone IV of the mapping area.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is a sparsely wooded version of *Penstemon newberryi - Streptanthus tortuosus* alliance that is also known from the Harvey Monroe Hall Research Natural Area, Inyo National Forest, California (Taylor, 1984). It occurs on glaciated granitic and metamorphic substrate that has very poor soil development.

**Yosemite and environs**

*Pinus contorta/Penstemon newberryi* woodland is found at high elevations (8,600–9,700 feet) on moderately steep to somewhat steep slopes (10–20 degrees) that are generally convex in shape. Aspect varies from northeast to west but tends to be west facing. These sites are usually shallow, well drained soils formed on granitic parent material. Soils are generally poorly developed and stony with textures ranging from stony and gravelly to stony, gravelly, sandy loam.

MOST ABUNDANT SPECIES

**Globally**

No species are abundant in this association due to the sparse nature of all structural layers.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Penstemon newberryi* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Penstemon newberryi* |

VEGETATION DESCRIPTION

**Globally**

This association is a sparsely wooded version of *Penstemon newberryi - Streptanthus tortuosus* alliance that is also known from the Harvey Monroe Hall Research Natural Area, Inyo National Forest, California (Taylor, 1984).

**Yosemite and environs**

Stands of *Pinus contorta/Penstemon newberryi* woodland are characterized by an open overstory tree layer dominated by *Pinus contorta.* Rarely, *Pinus monticola* is found contributing minor cover to the tree layer. The herb layer is also open. *Penstemon newberryi* is constant in the understory based on field verification. However, no supporting herbaceous data are available from Wieslander plots. *Juncus* sp. *(*probably mostly *Juncus parryi)* is often present and *Carex* sp. is occasionally present. A variety of other species may be found contributing to minor cover in the understory shrub and herbaceous layers including *Arctostaphylos nevadensis, Chrysolepis sempervirens, Quercus vaccinifolia, Antennaria media (= Antennaria alpina* var. *media), Spiraea splendens (= Spiraea densiflora), Holodiscus discolor,* and *Eriogonum umbellatum* var. *umbellatum.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | May not be particularly common; restricted to glaciated outcrops within upper reaches of *Pinus contorta* alliance zone in the central and perhaps southern Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

This assoiation is not a forest or a woodland but is characterized and defined by *P. contorta* var. *murrayana.* It would not be considered part of the same alliance as other forested *P. contorta* stands in the study area, but is included herein to reduce proliferation of additional alliances defined by the same nominate species (in this case, *P. contorta* var. *murrayana*).

**Yosemite and environs**
This type is split from *Pinus contorta* woodland (Potter, 1998) based on the extremely open nature of the stands; more like a sparsely wooded version of *Penstemon newberryi - Streptanthus tortuosus* alliance (Taylor, 1984), ecologically intermediate between that alliance and *Pinus contorta* woodland of Potter (1994).

**Plots used to describe association (n=5)**
Wieslander: **758, 740, 724, 617, 397**

---

***Pinus contorta* var. *murrayana/Artemisia tridentata* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Big Sagebrush Forest** |
| **SYNONYM** | **Lodgepole Pine/Sagebrush Association (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
The alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States. The association occurs predominantly on the east side of the Sierra Nevada at middle to upper elevations near the Sierra Crest. Stands occur on the west side of the crest on drier substrates and on edges of well drained meadows in the subalpine zone. Along with the *Pinus contorta* var. *murrayana* and *Abies magnifica - Pinus monticola* associations, these are the stands in the upper montane forest that transition into subalpine vegetation at still higher elevations. Stands can cover extensive areas but usually are less than 50 acres due to landscape fragmentation.

**Yosemite and environs**
This association appears to be uncommon in Yosemite and environs. Plots are sampled in the Virginia Lakes area of the east side and Tenaya Lake area of the west side. It is likely that most stands are on the east side of the crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
Elevations typically are above 8,500 feet, and preferred aspects are southeast and southwest (Potter 1998). Stands are often located on moderate to somewhat steep slopes, generally on the middle and lower portions of a slope, but sometimes on upper slopes and on broad ridge tops. In comparison to other upper montane associations, this has significantly higher levels of surface gravel and shallower litter depths.

**Yosemite and environs**

This association is found on lower to midmountain slope positions from 8,100–9,200 feet in elevation. Slopes are gentle to somewhat steep with eastern aspects. Soils are somewhat poorly drained to moderately drained with loamy sand and sandy loam textures. They are derived from granite bedrock. Litter/Duff cover averages 45 percent.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |

VEGETATION DESCRIPTION

**Globally**

Stands of *Pinus contorta* var. *murrayana/Artemisia tridentata* forest are open woodlands with a shrubby understory of *Artemisia tridentata*. Tree cover is low compared to many other sites in Sierra Nevada forests, and trees tend to occur as scattered clumps and individuals (Potter 1998). Stands are dominated by *Pinus contorta* var. *murrayana*, with an average 31 percent cover in the tree overstory. *Abies magnifica* is often present with an average 21 percent cover in the tree overstory layer, but in many cases, *Pinus contorta* is the only component of the overstory; *Abies magnifica* occurs only as widely scattered individuals in the understory. An open shrub layer dominated by *Artemisia tridentata*, which averages 18 percent cover, characterizes understories. Both the shrub and herbaceous layers are substantially higher than most other Sierra forests, and the herbaceous layer is among the highest in the upper montane of the Sierra Nevada.

**Yosemite and environs**

The tree layer is composed solely of *Pinus contorta* var. *murrayana*, with cover averaging 39 percent in the 5–35 meter height range, while the shrub layer, composed primarily of *Artemisia tridentata*, averages 19 percent cover. Other shrubs, making up less than 2 percent cover, include *Chrysolepis sempervirens*, *Leptodactylon pungens*, and *Purshia tridentata*. The herbaceous layer averages 7 percent cover; the most frequent species are *Arabis inyoensis*, *Arabis platysperma*, and *Elymus elymoides*.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Probably relatively common on the east side, but data to substantiate are currently lacking. Potter's (1994) sample size is only 11 for the entire range. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

Probably mostly found in the Lundy Canyon, Lee Vining Canyon, and Virginia Lakes regions, locally.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 98M53, 99K110

***Pinus contorta* var. *murrayana/Ledum glandulosum* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Western Labrador tea Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
Although the alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States, this association has only been described from Yosemite and environs. Taylor (1984) originally described it for the Hall Research Natural Area within the environs of the study area. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is localized in Yosemite and environs in moist to hydric sites in the subalpine zone.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory. Taylor (1984) describes this association as the most mesic of the three *Pinus contorta* associations he defined from the Hall RNA.

**Yosemite and environs**
This association is found along small streams and on the edges of meadows, or on slightly higher elevations in meadows, from approximately 7,700–9,000 feet in elevation on flat to gentle slopes of variable aspects. Microtopography is sometimes hummocky with *Ledum* and pines growing on slightly elevated portions of more saturated surrounding terrain. Soil textures range from silty loam of granitic origin to muck. Soils are somewhat poorly drained to poorly drained. Litter/Duff cover ranges from 20–95 percent. Sites are palustrine.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Ledum glandulosum* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Ledum glandulosum* |

VEGETATION DESCRIPTION

**Globally**

This association is only known Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

The tree layer is composed almost solely of *Pinus contorta* var. *murrayana,* averaging 15–20 meters in height and about 20 percent cover. *Ledum glandulosum* provides an average of 47 percent cover in the shrub layer, which is generally 0.5–1 meter. Other (sub)shrubs include *Spiraea splendens* var. *splendens, Vaccinium uliginosum,* and *Kalmia polifolia; Pinus contorta* var. *murrayana* saplings are also present in the shrub layer. The herb layer is variable, with *Chamerion angustifolium (= Epilobium angustifolium), Perideridia parishii, Calamagrostis canadensis, Deschampsia caespitosa,* and *Carex utriculata* providing most of the cover in this layer. There are another 62 mostly wetland meadow species included in the plot summaries, but most of them average only trace cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3S3? |
| RANK JUSTIFICATION | At this time only known from Yosemite, however, suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada. Generally restricted to moist subalpine riparian and other palustrine settings. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

This association is related to *Pinus contorta* var. *murrayana/Vaccinium uliginosum* forest. However, *Ledum glandulosum* appears to be more shade tolerant and more likely to occur in slightly drier and/or more well drained settings than *Vaccinium uliginosum.* The lower cover of moss in this association is also indicative of perhaps less acidic situations.

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 99K171, 99S168, 98K114, 99K141
Wieslander: **486, 112**

***Pinus contorta* var. *Murrayana/Vaccinium uliginosum* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Bog Blueberry Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

Although the alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States, this association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is found along small streams and on the edges of meadows, or on slightly higher elevations in meadows, from approximately 7,500–9,600 feet in elevation on gentle to moderate slopes of variable aspects. Soil textures range from silty loam of granitic origin to muck. Soils are somewhat poorly drained to poorly drained. Litter/Duff cover ranges from 20–95 percent. Sites are palustrine.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Vaccinium uliginosum, Kalmia polifolia* |
| Herbaceous | *Carex utriculata, moss* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Shrub | *Vaccinium uliginosum* |

Herbaceous Moss

VEGETATION DESCRIPTION
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
The tree layer is composed almost solely of *Pinus contorta* var. *murrayana*, ranging up to 35 meters in height and up to 37 percent cover. *Vaccinium uliginosum* provides from 15–87 percent cover in the shrub layer, which is generally under 0.5 meter. Other (sub)shrubs include *Vaccinium caespitosum* and *Kalmia polifolia; Pinus contorta* var. *murrayana* saplings are also present in the shrub layer. The herb layer is variable, with *Carex utriculata* providing most of the cover in this layer; other species include *Mimulus primuloides, Juncus drummondii,* and *Oreostemma alpigenum* var. *alpigenum.* Moss covers 5–40 percent of the ground.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3?

RANK JUSTIFICATION At this time only known from Yosemite, however, suspected of being in Sequoia and Kings Canyon national parks and other areas of the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association occurs on the edges of small streams and meadows, where, in some cases, *Pinus contorta* var. *murrayana* seems to be invading. *Vaccinium uliginosum* is somewhat shade tolerant and may also naturally occur in relatively dense and mature understories of *Pinus contorta* var. *murrayana.*

**Plots used to describe association (n= 4)**
USGS–NPS Veg Data: 99K144, 99K164, 99S123, 99S169

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***Pinus contorta* var. *murrayana/Carex rossii* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine/Ross Sedge Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

While the alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States, this association has been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory. It is suspected of occurring as far south as Sequoia and Kings Canyon national parks.

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of this association is not available without additional inventory. It has been described from the east side of the crest in the H. M. Hall RNA as a xeric subalpine forest type (Taylor, 1984).

**Yosemite and environs**
This association is found on lower to midmountain slope positions from approximately 8,200–10,100 feet in elevation. Slopes are gentle to somewhat steep with variable aspect. Soils are well drained with textures ranging from loamy sand to gravels. They are derived primarily from granite, though sometimes metamorphic, bedrock. Litter/Duff cover ranges from 35–45 percent, and large rock cover may be up to 20 percent.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs (Taylor, 1984). Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Carex rossii, Achnatherum occidentale* ssp. *occidentale, Phlox diffusa* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* (Taylor, 1984) |
| Herbaceous | *Carex rossii*, *Poa wheeleri* (Taylor, 1984) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Carex rossii* |

VEGETATION DESCRIPTION
**Globally**
Herbaceous understory is sparse (Taylor, 1984). Species present indicate poor site moisture status.

**Yosemite and environs**
An herb layer ranging from less than 10 percent to 25 percent cover characterizes stands of *Pinus contorta* var. *murrayana* - *Carex rossii* forest. This layer is primarily *Carex* species (assumed by further field inspection to be mostly *C. rossii*). Other species in the herb layer may include *Phlox diffusa* and *Juncus parryi*. There is virtually no shrub layer. The tree layer is composed almost solely of *Pinus contorta* var. *murrayana*, with cover ranging from 35–65 percent cover. Modal stands are relatively dense woodlands or forests with only scattered sun fleck openings. This is typically a more closed forest than the *P. contorta* var. *murrayana/Carex exserta* association.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Currently it is uncertain how common this is in the High Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
Further plot data with full species lists of understory species will be necessary before a full description is available.

**Plots used to describe association (n=4)**
NRI: 171, 176, 230
Wieslander: **113**

---

***Pinus contorta* var. *murrayana / Carex exserta (Carex filifolia* var. *erostrata,* Hickman 1993) Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine / Shorthair Sedge Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
While the alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States, this association has been described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory. It is likely that this association occurs as far south as at least Sequoia and Kings Canyon national parks.

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of this association is not available without additional inventory.

**Yosemite and environs**
This association is found on lower to midmountain slope positions from approximately 8,200–10,100 feet in elevation. Slopes are gentle to somewhat steep with variable aspect. Soils are well drained with textures ranging from loamy sand to gravels. They are derived primarily from granite, though sometimes metamorphic, bedrock. Litter/Duff cover ranges from 35–45 percent, and large rock cover may be up to 20 percent. Typical landscape of this association is an open woodland with exposed boulders and granitic benches with intermittent sods of *Carex exserta* occupying the intervening patches of well drained gravelly or sandy soil.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Carex exserta* (=*Carex filifolia* var. *erostrata*) |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana* |
| Herbaceous | *Carex exserta* (=*Carex filifolia* var. *erostrata*) |

VEGETATION DESCRIPTION

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pinus contorta* var. *murrayana* - *Carex exserta* forest are characterized by an herb layer with 7–60 percent cover at less than 0.5 meter in height. This layer is primarily *Carex exserta* (= *Carex filifolia* var. *erostrata)*, which averages 28 percent cover. What negligible shrub layer exists consists primarily of young *Pinus contorta* var. *murrayana*. The tree layer is composed solely of *Pinus contorta* var. *murrayana*, ranging up to 20 meters in height with cover ranging from 1–38 percent and averaging 20 percent. Other herb species that may be present include *Achnatherum occidentale*, *Leptodactylon pungens*, and *Elymus elymoides.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4S4

RANK JUSTIFICATION It is common throughout high central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

We await data from Sequoia and Kings Canyon national parks to further elucidate the relationships with other associations and distribution of this association. Note: This association is typically a woodland or wooded herbland based on criteria on USNVC classification rules. However, it is related to denser stands of *Pinus contorta* var. *murrayana*, which are currently identified as *P. contorta/Carex rossii* forest association.

**Plots used to describe association (n=7)**

USGS–NPS Veg Data: 98K111, 99K118, 99K122, 99S139
NRI: 231
Wieslander: **579, 163**

***Pinus contorta* var. *murrayana* - *Pinus albicaulis / Carex rossii* Forest**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine - Whitebark Pine - Ross' Sedge Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
The alliance is widespread in the upper montane and subalpine zone of most major mountain ranges of the western United States. Information about the global characteristics of this association is not available without additional inventory.

**Yosemite and environs**
This association is common in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of this association is not available without additional inventory.

**Yosemite and environs**
This association is found from approximately 9,000–10,600 feet in elevation. Slopes are flat to steep. Aspect is variable but primarily southeast, south, southwest, and west. Soils are moderately well drained to well drained with textures ranging from loam to gravels. They are derived primarily from granitic, though sometimes metamorphic, bedrock. Large rock or bedrock cover may be up to 75 percent. This association often lies at the base of mountain slopes below more open subalpine woodlands and above more mesic woodlands of Sierra lodgepole pine alliance.

MOST ABUNDANT SPECIES
**Globally**
Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana, Pinus albicaulis* |
| Shrub | *Pinus contorta* var. *murrayana, Pinus albicaulis* |
| Herbaceous | *Carex rossii* |

CHARACTERISTIC SPECIES
**Globally**
Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana, Pinus albicaulis* |
| Herbaceous | *Carex rossii* |

VEGETATION DESCRIPTION
**Globally**

Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pinus contorta* var. *murrayana* - *Pinus albicaulis* - *Carex rossii* forest are characterized by a sparse to dense herb layer less than 0.5 meter. Herbaceous species vary greatly and may include *Arnica cordifolia* and *Juncus parryi*. The shrub layer ranges from 0–62 percent cover, primarily composed of *Pinus contorta* var. *murrayana* or *Pinus albicaulis.* Other species composing the shrub layer may include *Phyllodoce breweri* and *Ribes* species. The tree layer is composed of *Pinus contorta* var. *murrayana* and *Pinus albicaulis;* these are open, multiaged stands with mature trees, saplings, and pole-sized trees. Stands are woodland to forest in structure. *Carex rossii* is relatively shade tolerant and does not require hydric or even substantially mesic conditions. Thus, the understory is open and usually sparse with scattered sprigs of *C. rossii* and other relatively shade tolerant herbs.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4

RANK JUSTIFICATION Likely common in high central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is one of the most common and typical of the lodgepole associations found on lower slopes and edges of drier subalpine meadows throughout the subalpine zone.

**Plots used to describe association (n=32)**
USGS–NPS Veg Data: 98M94
NRI: 167, 168, 215, 187, 113, 361, 345, 270, 300, 301, 290, 292
Wieslander: **621, 275, 250, 19, 49, 149, 392, 287, 311, 263, 184, 186, 159, 153, 147, 105, 393, 273, 279**

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***Pinus contorta* var. *murrayana* - *Pinus albicaulis/Carex exserta* (*Carex filifolia* var. *erostrata,* Hickman 1993) Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Sierra Lodgepole Pine - Whitebark Pine / Shorthair Sedge Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is uncommon in Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association occurs between 10,000–10,500 feet in elevation. Aspects are southeast and southwest, and slopes are gentle to moderate. Soils are derived from granite and are sandy gravels to sand. Sites may be up to 80 percent bedrock.

MOST ABUNDANT SPECIES
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana, Pinus albicaulis* |
| Herbaceous | *Carex exserta* (=*Carex filifolia* var. *erostrata*) |

CHARACTERISTIC SPECIES
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus contorta* var. *murrayana, Pinus albicaulis* |
| Herbaceous | *Carex exserta* (=*Carex filifolia* var. *erostrata*) |

VEGETATION DESCRIPTION
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, tree cover averages between 5 and 25 percent, and is composed of *Pinus contorta* var. *murrayana* and *Pinus albicaulis*. These two species also make up the shrub layer, which averages 11 percent cover. These species occur in scattered clumps, often as krummholz. Actual shrub species are absent. The herb layer averages 23 percent cover and is composed of variable species, with the exception of *Pinus contorta* var. *murrayana* and *Pinus albicaulis,* which together make up an average 14 percent of this cover. *Carex exserta* (=*Carex filifolia* var. *erostrata*) averages 5 percent cover. Other herb species include *Lupinus lepidus, Selaginella watsonii,* and *Phlox diffusa.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION May be uncommon in central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This type is tentatively described because of field observations substantiating its existence beyond the two samples taken. Further samples are needed for a better understanding of this type.

**Plots used to describe association (n=2)**
NRI: 271, 173

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***Pinus monticola – Pinus contorta var. murrayana/Achnatherum occidentale* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Western White Pine-Sierra Lodgepole Pine/Western Needlegrass Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus monticola* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory

**Yosemite and environs**
This association is the typical *P. monticola* association in Yosemite and environs. It occurs on Buena Vista Crest, the ridge above Siesta Lake, the ridge west of Olmsted Point, Southeast of Cloud's Rest and other locations in the Tuolumne Meadows, Mono Craters and Matterhorn Peak 15 minute quadrangles and the Tamarack Flat, Mount Dana and Tenaya Lake 7.5 minute quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is described only from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association occurs between 7,700–10,160 feet in elevation, primarily on somewhat gentle to moderate slopes (1-15°, mean 7°), often near or partially on the tops of ridges. All aspects are represented, with no particular preference demonstrated.. Soils are derived from granite and tend to be shallow to moderate in depth. Textures are sand or sandy loam. Large rock/boulder cover may reach 27 percent of the stand, but bare soil also may reach 75 percent. Sites are upland.

MOST ABUNDANT SPECIES
**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory. Similar *P. monticola* dominated woodlands occur further south in the Sierra to at least Tulare County (Keeler-Wolf unpublished data, Mountaineer Creek Research Natural Area)

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monticola, Pinus contorta* var. *murrayana* |
| Herbaceous | *Achnatherum occidentale* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monticola, Pinus contorta* var. *murrayana* |
| Herbaceous | *Achnatherum occidentale* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

In Yosemite and environs, this association consists of an open tree canopy dominated by *Pinus monticola*, which averages 20 percent cover. *Pinus contorta* var. *murrayana* is also of regular occurrence averaging about 15 percent in the tree layer. The shrub layer is essentially nonexistent except for young or stunted individuals of *P. monticola* and *P. contorta murrayana* and irregular individuals of *Arctostaphylos nevadensis and Chrysolepis sempervirens* (both < 1% cover and 15% frequency or less). The herb layer averages 10 percent cover, with the most frequent species being *Achnatherum occidentale* and *Elymus elymoides* . Other herb species that may be present include *Arabis platysperma, Leptodactylon pungens, Cistanthe umbellata var. umbellata, Lupinus lepidus, Collinsia torreyi var. torreyi* and *Eriogonum incanum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3S3

RANK JUSTIFICATION Probably uncommon throughout its range in the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

This association is a re-combination of the former *Pinus monticola/Achnatherum occidentale* and *P. monticola-P. contorta* var. *murrayana*. It is now believed that all stands represented by the former two associations are now sufficiently homogeneous to be lumped into a single association.

**Plots used to describe association (n=30)**

USGS–NPS Veg Data: 99K108, 99K126, 98K53
NRI: 172, 211, 261, 77,110, 178, 209, 210, 330
Wieslander: **89, 90, 217, 226, 230, 267, 269, 326, 371, 372, 391, 529, 575, 603, 671, 764, 768**
Potter: 2026

***Tsuga mertensiana* Forest**

| | |
|---|---|
| **COMMON NAME** | **Mountain Hemlock Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Tsuga mertensiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
Stands of *Tsuga mertensiana* forest are found throughout the Sierra Nevada, however, predominantly north of the Kings River (Potter, 1998).

**Yosemite and environs**
Stands of *Tsuga mertensiana* forest are sampled in the mapping area of Yosemite and environs within the Tower Peak 15-minute, Tuolumne Meadows 15-minute, and Tenaya Lake 7.5-minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is found at mid to high elevations (7,400–9,200 feet) on gentle to somewhat steep (2–29%) slopes. Aspect varies but is often on northeast-facing slopes. Microrelief is usually broken and hummocky. Sites are found at lower to upper portions of slopes and rarely are on ridge tops. Soils are typically from granitic parent material; however, some stands to the north are derived from volcanic or mixed lithology. These soils are typically greater that 25 inches and occasionally greater than 35 inches. Very little bare soil is usually exposed. Soil depths range from 14–40 inches. Soil textures range from sand to loam and are excessively drained to well drained (Potter, 1998).

**Yosemite and environs**
Stands of *Tsuga mertensiana* forest are found at midhigh elevations (7,300–9,800 feet) on concave-shaped, moderately steep to somewhat steep slopes (14–20 degrees). These sites are found on lower to upper portions of slopes. Aspect varies from east to northwest; however, it tends to be north facing. The sites are often somewhat stony. Soils are poorly developed to well developed with soil textures ranging from stony gravel to loam from granitic parent material. Fire and disturbance are uncommon in this association, and litter can accumulate to a cover value of 70–88 percent.

MOST ABUNDANT SPECIES
**Globally**
Tree *Tsuga mertensiana, Abies magnifica, Pinus contorta* var. *murrayana* (Potter, 1998)

**Yosemite and environs**
Tree *Tsuga mertensiana, Abies magnifica*

CHARACTERISTIC SPECIES
**Globally**
Tree *Tsuga mertensiana, Abies magnifica, Pinus contorta* var. *murrayana* (Potter, 1998)

**Yosemite and environs**
Tree *Tsuga mertensiana, Abies magnifica, Pinus contorta* var. *murrayana*

VEGETATION DESCRIPTION
**Globally**
Stands of *Tsuga mertensiana* forest form a dense forest with an open understory. The tree layer is dominated by *Tsuga mertensiana* mixed with *Abies magnifica. Pinus contorta* var. *murrayana* and *Pinus monticola* are also important overstory tree species. The understory layers are typically open. Occasional shrub species may include *Ribes roezlii (= Grossularia roezlii)* and *Ribes montigenum.* Herb species may include *Eucephalus breweri (= Aster breweri), Hieracium albiflorum, Poa bolanderi,* and *Carex rossii.* Conifer regeneration is high at this association and is dominated by *Abies magnifica* with significantly lower amounts of *Tsuga mertensiana* (Potter, 1998).

**Yosemite and environs**
Stands of *Tsuga mertensiana* forest form a three-story structure t with a continuous overstory tree layer that is dominated by *Tsuga mertensiana,* although *Abies magnifica* and *Pinus contorta* var. *murrayana* are also important. *Pinus monticola* and *Abies magnifica* are often common in this association. *Pinus albicaulis* is rarely present in some stands. A variety of other species that may be found in the understory herb and shrub layers includes *Carex rossii, Antennaria media (= Antennaria alpina* var. *media), Arabis lyallii, Achnatherum pinetorum, Eucephalus breweri (= Aster breweri), Hieracium gracile, Juncus parryi, Oreostemma alpigenum* var. *alpigenum, Ribes montigenum, Poa secunda,* and *Poa fendleriana. Phyllodoce breweri* can be common at some sites. The structure of this association may have 0–20 percent cover at 35–50 meters tall, 5–70 percent cover at 20–35 meters tall, 0–5 percent cover at 15–20 meters tall, 10 percent cover at 10–15 meters tall, and 0–20 percent cover at 5–10 meters tall. The shrub layer has 5–10 percent cover at 2–5 meters tall, 0–5 percent cover at 1–2 meters tall, 0–5 percent cover at 0.5–1 meter tall, and 0–70 percent cover at 0–0.5 meter tall. The herb layer is often sparse with approximately 5 percent cover at 0–0.5 meter tall.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION Probably relatively widespread in the subalpine of the northern and central Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=20)**
USGS–NPS Veg Data: 99K117, 98K96, 98K101, 99S110
NRI: 159, 131, 122
Wieslander: **630, 235, 593, 587, 23, 690, 585, 227, 131, 133, 41, 109, 333**

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***Tsuga mertensiana - Pinus monticola* Forest**

| | |
|---|---|
| **COMMON NAME** | **Mountain Hemlock-Western White Pine Forest** |
| **SYNONYM** | **Mountain Hemlock/Steep (Potter, 1998) in part** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |

| | |
|---|---|
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Tsuga mertensiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is found throughout the northern regions of the Sierra Nevada, predominantly north of the Kings River, occurring more commonly in the northern portions of this range. Stands are usually less than 10 acres in size (Potter, 1998).

**Yosemite and environs**

Stands of *Tsuga mertensiana –Pinus monticola* forest are found at upper elevations on both slopes of the range.

ENVIRONMENTAL DESCRIPTION

**Globally**

Stands of *Tsuga mertensiana –Pinus monticola* forest are found at mid to high elevations (7,120–9,400 feet) on somewhat steep to steep (30–60%) broken and hummocky slopes. Aspects range from northeast to northwest, and snow pack typically lingers into the summer. This association is usually found on the upper portions of slopes just below ridge tops. Soils are moderately deep to deep (22–40+ inches) often greater than 40 inches. Soil texture varies between gravelly sands, gravelly sandy loams, and gravelly loams above sands and sandy loams. Soils are usually excessively drained due to coarse textures. Parent material is granitic or volcanic (including pumice) but rarely metamorphic (Potter, 1998).

**Yosemite and environs**

Stands of *Tsuga mertensiana-Pinus monticola* forest are found at mid to high elevations (8,200–9,900 feet) on moderately steep to somewhat steep, north- and west-facing slopes. Slopes are generally concave in shape. These sites are typically found on the mid to upper portion of slopes with soils that are poorly developed to moderately developed with textures ranging from stony to stony loam. These soils are generally well drained, shallow to deep, and from granitic parent material. Snow accumulation is the highest of any subalpine forest type. This association and many of the high-elevation conifer associations are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold.

MOST ABUNDANT SPECIES

**Globally**

Tree *Tsuga mertensiana, Abies magnifica* (Potter, 1998)

**Yosemite and environs**

Tree *Pinus monticola*

CHARACTERISTIC SPECIES

**Globally**

Tree *Tsuga mertensiana, Pinus monticola*

**Yosemite and environs**

Tree *Tsuga mertensiana, Pinus monticola*

VEGETATION DESCRIPTION

**Globally**

Stands of *Tsuga mertensiana - Pinus monticola* forest form moderately dense forests dominated by *Tsuga mertensiana*. *Pinus monticola* and *Abies magnifica* are also significant. *Pinus contorta* occasionally contributes to minor cover. The shrub layer is essentially nonexistent. The understory herb layer is typically sparse and may

include low amounts of *Arabis platysperma, Hieracium albiflorum, Pedicularis semibarbata, Phacelia hydrophylloides, Poa bolanderi, Poa secunda (= Poa gracillima),* and *Carex* sp. (Potter, 1998).

**Yosemite and environs**
This association consists of mixed-aged, open to dense forest stands dominated by *Tsuga mertensiana*, with an average 44 percent cover, and *Pinus monticola*, with an average 8 percent cover. Sapling *Tsuga mertensiana* is the most frequent species in the otherwise almost nonexistent shrub layer. The herb layer is less than 6 percent cover. The most frequent species in this layer are seedling *Tsuga mertensiana* and *Pinus monticola.* The understory is typically open and may have *Arabis platysperma, Poa secunda, Arabis lyallii, Phyllodoce breweri, Ribes montigenum, Poa wheeleri, Juncus parryi*, and *Carex rossii.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: This and *Tsuga mertensiana/*steep association of Potter (1998) have been merged in this discussion. Potter's (1998) description was limited to stands within the distribution of *Abies magnifica* (California red fir). However, *Pinus monticola* typically ascends somewhat higher in elevation in the central Sierra Nevada and makes a better constant indicator of the moderately to steeply sloping midslope *Tsuga mertensiana* alliance stands. Thus, we have renamed this association.

**Plots used to describe association (n=19)**
USGS–NPS Veg Data: 98K106, 99K145, 99K166
NRI Data: 287
Wieslander plots: **108, 387, 615, 364, 658, 567, 225, 265, 331, 654, 650, 652, 760, 547, 549**

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***Tsuga mertensiana - Pinus contorta* var. *murrayana* Forest**

| | |
|---|---|
| **COMMON NAME** | **Mountain Hemlock – Sierra Lodgepole Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Tsuga mertensiana* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta* var. *murrayana* forest are found at upper elevations in the mapping area of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta* var. *murrayana* forest are found at high elevations (8,700–9,900 feet) on the upper portions of gentle to steep slopes (4–45 degrees). Aspect varies but tends to be northerly. Slopes are often concave in shape. These sites are typically found on poorly developed to moderately well developed soils with textures ranging from stony gravel to loams. Soils are usually well drained with depths that are shallow to deep. Parent material is granitic. Fire is uncommon and often restricted in size. This association and many of the high-elevation conifer association are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Tsuga mertensiana, Pinus contorta*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Tsuga mertensiana, Pinus contorta*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta* var. *murrayana* forest form sparse to moderately dense forests dominated by *Tsuga mertensiana* and *Pinus contorta,* although *Pinus contorta* is less abundant. Other tree species that may be found contributing to minor cover in this association include *Abies magnifica, Pinus monticola, Pinus jeffreyi,* and *Pinus albicaulis.* The understory layer is often open and may include *Juncus* sp., *Lupinus sellulus* var. *lobbii (= Lupinus lepidus* var. *lobbii), Lupinus covillei, Carex rossii, Chrysolepis sempervirens,* and *Antennaria media (= Antennaria alpina* var. *media). Phyllodoce breweri* may form patches in the small openings along with occasional herbs and grasses including *Cassiope mertensiana, Pyrola minor, Mitella breweri, Calamagrostis stricta* ssp. *inexpansa, Luzula parviflora, Solidago multiradiata, Senecio scorzonella,* and *Trisetum spicatum.* The shrubs *Holodiscus discolor, Ribes montigenum, Lonicera conjugialis,* and *Spiraea splendens (= Spiraea densiflora)* are occasional. Occasional moist lower slope sites may include additional mesophytic species such as *Carex leporinella, Senecio triangularis,* and *Salix lemmonii*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION May be fairly common in the northern and central Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: After reanalysis of plot data, the preliminary classification units T. mertensiana-P. contorta/Phyllodoce *breweri* and *T. mertensiana-P. contorta/Carex rossii* have been subsumed within this association. Because most of the plots used to define these types are from Wieslander data, which lacks detailed understory species composition, this current association may be thought of as a suballiance category that could possibly be further subdivided with full species plot data.

**Plots used to describe association (n=32)**
NRI Data: 249, 201, 204, 197
Wieslander: **609, 581, 545, 510, 470, 167, 135, 145, 117, 29, 648, 110, 35, 15, 410, 141, 607, 518, 535, 161, 638, 613, 589, 561, 563, 565, 569, 256**
Potter: 1614

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***Tsuga mertensiana - Pinus contorta - Pinus monticola* Forest**

| | |
|---|---|
| **COMMON NAME** | **Mountain Hemlock – Sierra Lodgepole Pine - Western White Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen forest |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Conical-crowned temperate or subpolar needle-leaved evergreen forest |
| ALLIANCE | *Tsuga mertensiana- Pinus contorta* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory. However, similar stands are likely to occur throughout the northern and central Sierra Nevada subalpine zone.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta - Pinus monticola* forest are found at upper elevations in the mapping area, most likely on both slopes of the range. It was sampled only on the west slope.

ENVIRONMENTAL DESCRIPTION
**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta - Pinus monticola* forest are found at mid to high elevations (8,100–9,600 feet) on flat to steep slopes (0–32 degrees). These slopes are on all aspects; however, they are predominantly found on north-, northwest- and east-facing slopes. Soils are poorly developed to moderately well developed with textures ranging from stony gravel to gravelly loam. These soils are well drained and depth ranges from shallow to deep. Parent material is granitic.

MOST ABUNDANT SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory

**Yosemite and environs**
Tree *Tsuga mertensiana, Pinus contorta, Pinus monticola*

CHARACTERISTIC SPECIES
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Tsuga mertensiana, Pinus contorta, Pinus monticola*

VEGETATION DESCRIPTION
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Tsuga mertensiana - Pinus contorta - Pinus monticola* forest are characterized by *Tsuga mertensiana, Pinus contorta,* and *Pinus monticola;* however, *Tsuga mertensiana* is most abundant. *Abies magnifica* is occasionally present in the overstory. The understory herb and shrub layers are open and include *Juncus* sp., *Lupinus* sp., *Ribes montigenum, Arctostaphylos nevadensis, Carex* sp., *Salix* sp., and a variety of other species contributing to minor cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION These mixed stands are likely to be relatively uncommon throughout their range in the Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
The Yosemite region may have some of the best developed stands of this association.

**Plots used to describe association (n=23)**
**NRI plots: 208**

**Wieslander:** 7, 2, 734, 744, 577, 234, 240, 728, 730, 757, 759, 762, 591, 583, 395, 139, 233, 242, 82, 96, 4, 619, 537

***Pinus albicaulis - Tsuga mertensiana* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Whitebark Pine - Mountain Hemlock Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus albicaulis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. It is suspected from the central and northern Sierra Nevada.

**Yosemite and environs**

This association is commonly found throughout the subalpine regions of the park.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found between 8,900–10,800 feet of elevation. Slopes are moderate to steep, often concave, and aspects are north and east. Stands grow in cool, moist settings in lower to midslope positions. Soils are generally shallow and poorly to moderately well developed with textures that range from stony gravel to stony, gravelly, and sandy loam. Soils are well drained with soil depths ranging from shallow to deep. Parent material is granite. Fire is uncommon and restricted in size. Disturbance levels are usually low at this association.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis, Tsuga mertensiana* |
| Shrub | *Ribes montigenum* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Pinus albicaulis, Tsuga mertensiana*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is codominated by *Pinus albicaulis* and *Tsuga mertensiana,* each providing between 5–30 percent cover. *Ribes montigenum* (1.5% cover) and *Salix drummondiana* (0.75% cover) are common shrub associates. The herbaceous understory is quite diverse with a large variety of forbs and graminoids. Total herbaceous cover averages 20 percent. Common forbs include *Selaginella watsonii* (1% cover), *Antennaria rosea* (0.25% cover), *Phyllodoce breweri, Sedum obtusatum, Phlox diffusa, Penstemon newberryi, Cryptogramma acrostichoides, Antennaria rosea,* and *Elymus elymoides* ssp. *californicum,* and/or *Arabis platysperma* (0.25% cover). Graminoids may include *Carex exserta (C. filifolia* var. *erostrata*) (10% cover), *Carex rossii, Juncus parryi* (1%), and/or *Trisetum spicatum* (0.25% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION Probably fairly common and widespread throughout the High Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=17)**
USGS–NPS Veg Data: 99K131, 99S153, 99S98, 99K132
NRI: 358, 170, 206, 250, 303, 304, 356
Wieslander: **611, 3, 626, 39, 406, 512, 85, 87, 106, 137, 624, 634, 143, 281, 378, 571, 632**

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***Pinus albicaulis/Carex exserta* (Carex *filifolia* var. *erostrata,* Hickman 1993) Woodland**

| | |
|---|---|
| **COMMON NAME** | **Whitebark Pine/Shorthair Sedge Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus albicaulis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. It is likely to extend south to Sequoia and Kings Canyon national parks.

**Yosemite and environs**

Stands of this association are found at scattered locations in the alpine regions of the park.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association typically grow on southwest to southeast exposures between 10,200–11,300 feet of elevation. Slopes are moderate to steep. Sites are very stony, often dominated by granitic slabs or boulders, with patches of sandy soil interspersed. Annual precipitation is quite high with the bulk falling as winter snow. Summers are brief and droughty.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Herbaceous | Carex exserta (=*Carex filifolia* var. *erostrata*) |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Herbaceous | *Carex exserta* (=*Carex filifolia* var. *erostrata)* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association have an open canopy of *Pinus albicaulis* (20% cover) with an intermittent herbaceous understory. Often trees form krummholz. Occasional individuals of *Pinus contorta* may be present. The shrub layer is absent or very sparse. Graminoids are the most common plants in the herbaceous layer, most often *Carex exserta* (=*Carex filifolia* var. *erostrata*), which contributes 26 percent cover. In the rockiest stands *Carex exserta* may be absent. Other graminoids present may include *Carex subnigricans* (0.5% cover), *Elymus elymoides* (0.5% cover), and/or *Trisetum spicatum* (0.5% cover). The most common forbs include *Penstemon heterodoxus* (1% cover), *Antennaria corymbosa* (0.5% cover), *Cistanthe umbellata* (0.5% cover), *Gayophytum diffusum* (0.5% cover), *Pyrrocoma apargioides* (0.5% cover), and/or *Silene sargentii* (0.5% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

| | |
|---|---|
| RANK JUSTIFICATION | Likely to commonly occur as a subalpine woodland throughout the High Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=10)**
USGS–NPS Veg Data: 98K123, 98M113
NRI: 79, 160, 232, 245, 256, 262, 310
Wieslander: **252**

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***Pinus albicaulis/(Penstemon davidsonii*) Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Whitebark Pine/(Davidson's Penstemon) Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus albicaulis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been defined within Inyo National Forest within the study area (Taylor 1984). It is suspected to be in Sequoia and Kings Canyon national parks as well.

**Yosemite and environs**
This association is known from two locations at timberline within the park. The best example is near Mammoth Peak. Stands have been observed on both the east (e.g., Virginia Lakes Basin) and west sides of the crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association grows on stony sites with patches of sandy soil between boulders. The elevational range is between 10,200–11,400 feet. Aspects are west, and slopes are moderate.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Herbaceous | *Lupinus lepidus* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Forb | *Penstemon davidsonii* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is dominated by stunted *Pinus albicaulis* that provides between 22–43 percent cover. Scattered individuals of *Pinus contorta* may be present. Forbs are scattered and sparse. Common forb associates include *Lupinus lepidus* (3.7% cover), *Eriogonum ovalifolium* (1% cover), *Arenaria kingii* ssp. *compacta* (0.67% cover), *Penstemon davidsonii* (0.5% cover), and/or *Castilleja nana* (0.17% cover). The graminoid species that may be present at low cover values (< 1% cover) include *Poa glauca* ssp. *rupicola* and *Elymus elymoides*. Taylor's (1984) samples from the eastern portion of the study area indicated a poorly developed wind-pruned canopy with a canopy height of less than 5 m and a sparse understory.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3G4? |
| RANK JUSTIFICATION | Probably common in the xeric subalpine of the central and southern Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
Taylor (1984) has six additional samples from the eastern portion of the study area. His samples indicate high constancy for *Pinus albicaulis* and *Carex rossii* only. *Penstemon davidsonii* may not be the best indicator for treeline stands of *Pinus albicaulis* that are commonly wind-pruned and have few to no other conifers present. Further sampling is needed to clarify floristic characteristics of this type.

**Plots used to describe association (n=2)**
NRI: 309
Wieslander: **373**

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***Pinus albicaulis/Carex rossii* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Whitebark Pine/Ross' Sedge Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |

| | |
|---|---|
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus albicaulis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Additional plots were sampled within the study area by Taylor (1984) in the Harvey Monroe Hall Research Natural Area. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association is only known from a few locations near the Sierra Nevada Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association have been found on sites between 10,000–10,600 feet of elevation on east and west aspects. Slopes are moderate to steep, and stands have been found on a variety of topographic positions. Sites are stony interspersed with patches of coarse soil.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Herbaceous | *Ivesia santolinoides, Carex rossii* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus albicaulis* |
| Graminoid | *Carex rossii* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is characterized by *Pinus albicaulis* (mean 15% cover; may be dwarfed) with occasional emergent individuals of *Pinus contorta*. *Ribes montigenum* and *Artemisia tridentata* may be present in the shrub layer. The herbaceous layer is sparse and not very diverse. Total herbaceous cover averages about 10 percent. *Carex rossii* is the characteristic graminoid, attaining 2 percent cover. Other common graminoid associates include *Juncus drummondii*, *Carex exserta (C. filifolia* var. *erostrata*), and/or *Achnatherum occidentale*. Forbs commonly found with this association may include *Ivesia santolinoides*, *Arenaria kingii* ssp. *compacta*, *Lupinus confertus*, and/or *Arabis platysperma*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION May be a relatively uncommon type of the central and southern Sierra Nevada subalpine zone.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This association includes the *Pinus albicaulis/Poa wheeleri* woodland of Taylor (1984). Further sampling and analysis will be necessary to confirm this decision. Based on the data available, however, these two seem to be synonomous, with more data supporting *C. rossii* as the understory constant.

**Plots used to describe association (n=5)**
NRI: 200, 243, 346, 347, 349
Taylor (1984) has additional plots in the study area

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***Juniperus occidentalis* var. *australis* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Juniper Woodland** |
| **SYNONYM** | **Western Juniper Association (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Juniperus occidentalis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is found throughout the central and southern regions of the Sierra Nevada, predominantly north of the Kern Plateau and the Kings River. Stands occur in widely separated patches across the landscape many less than 10 acres in size (Potter, 1998).

**Yosemite and environs**

This association is found in upper montane to subalpine regions of the mapping area, mainly west of the crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

Elevations typically lie between 7,500-8,500 feet (Potter 1998). Sites are typically on southeast and southwest aspects and generally on upper and middle slopes. Slopes are typically steeper than 20 percent. Microrelief is typically undulating to hummocky and broken. This type has significantly more bare ground and surface rock than most other associations (surface rock generally greater than 15 percent).

**Yosemite and environs**

This association is typically found between 7,200–8,500 feet of elevation. Stands typically grow on southeast and southwest aspects with high solar radiation. Slopes are often steeper than 20 percent, and sites prefer middle and upper slope positions. Stands have a high percentage of bare ground and surface rock, sometimes as much as 50 percent. Stands in the Juniperus occidentalis ssp. australis/Arctostaphylos nevadensis woodland phase may be found between 8,300 and 9,800 feet elevation. They occur on west, south and east aspects and on slopes steeper than 35 percent. Shallow soils are rocky and of granitic origin.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Tree | Juniperus occidentalis var. australis (Potter 1998) |
| Shrub | Arctostaphylos nevadensis, Quercus vaccinifolia (Potter 1998) |
| Herbaceous | Collinsia torreyi (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Quercus vaccinifolia* |
| Herbaceous | *Juncus nevadensis* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Tree | Juniperus occidentalis var. australis (Potter 1998) |
| Shrub | Arctostaphylos nevadensis, Quercus vaccinifolia (Potter 1998) |
| Herbaceous | Erigeron breweri, Monardella odoratissima (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Quercus vaccinifolia* |

VEGETATION DESCRIPTION

**Globally**

Stands are characteristically open, shrubby woodlands (Potter 1998). Tree distribution is often clumped and patchy. Overstories are dominated by *Juniperus occidentalis* var. *australis*, *Pinus contorta* var. *murrayana* and *Pinus jeffreyi*. *Abies magnifica*, *Abies concolor*, and *Pinus monticola* are occasional components in the overstory. Understories are dominated by species that favor dry habitats. Arctostaphylos nevadensis, Quercus vaccinifolia are usually present. *Ceanothus cordulatus, Prunus emarginata, Symphoricarpos rotundifolius* are sometimes present. The herbaceous layer contains dry-site species such as *Eriogonum nudum, Elymus elymoides, Achnatherum occidentalis* as well as dry to moderate indicators such as *Monardella odoratissima, Gayophytum eriospermum.* Sites typically have high species diversity. These stands are often surrounded by dense forested communities where conditions become more mesic.

**Yosemite and environs**

This association is an open woodland with clumped and patchy tree distribution and high understory diversity. *Juniperus occidentalis* var. *australis* is the dominant tree, attaining only about 9 percent cover. Common tree

associates include *Pinus contorta* (2% cover) and *Pinus jeffreyi* (1.8% cover). *Quercus vaccinifolia* is the dominant shrub, attaining 12 percent cover. *Holodiscus discolor* (0.75% cover), *Leptodactylon pungens* (0.75% cover), and/or *Spiraea splendens* (0.75% cover) are often present. These shrubs are all common dry-site indicators. The herbaceous/graminoid layer is quite diverse though somewhat sparse. The most common species include *Castilleja applegatei* (0.38% cover), *Juncus nevadensis* (0.38% cover), *Sedum obtusatum* (0.38% cover), *Streptanthus tortuosus* (0.38% cover), and/or *Juncus parryi* (0.75% cover). Many other herbaceous species can be present but at very low frequency and cover levels.

Stands in the Juniperus occidentalis ssp. australis/Arctostaphylos nevadensis woodland phase are open woodlands with sparse, patchy tree distribution. *Juniperus occidentalis* var. *australis* is the dominant tree with an average cover of 6.7 percent. *Pinus contorta* var. *murrayana* is often present (8.5% cover).Quercus vaccinifolia may be the dominant shrub (13% cover), but *Arctostaphylos nevadensis* is a consistent indicator species with 100% frequency. Other shrubs that may be present include *Amelanchier alnifolia*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=41)**
USGS–NPS Veg Data: 98M107, 98M86, 98MCHS6, 98MCHS7
NRI: 169, 236, 247, 229, 246, 334, 359, 191, 241, 248
Wieslander: **102, 91, 100, 77, 86, 101, 389, 688, 750, 74, 76, 80, 104, 212, 224, 336, 339, 612, 666, 702, 710, 13, 385, 374, (**Juniperus occidentalis ssp. australis/Arctostaphylos nevadensis woodland phase-
Wieslander: **394**, **732**, **742)**

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***Juniperus occidentalis var. australis/Holodiscus discolor* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Juniper/Oceanspray Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Juniperus occidentalis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is found in upper montane to subalpine regions of the mapping area, mainly west of the crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is typically found between 8,700–9,200 feet of elevation. Stands typically grow on southeast and southwest aspects with high solar radiation. Slopes are very steep, often more than 50 percent. Stands prefer middle and upper slope positions. Stands have a high percentage of bare ground and surface rock, often more than 50 percent.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Holodiscus discolor* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Holodiscus discolor* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
*Juniperus occidentalis* var. *australis* is the dominant tree species attaining approximately 4 percent cover. *Pinus contorta* (0.8% cover) and *Pinus monticola* (0.4% cover) are common associates. *Holodiscus discolor* is the diagnostic shrub species with 2 percent cover. Other shrubs that occur at lower frequency include *Arctostaphylos nevadensis* (7.6% cover), *Artemisia rothrockii* (6% cover), and *Amelanchier utahensis* (3% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: This is a tentative association and may be best considered a phase of the more widespread J. occidentalis var. *australis* association. It is identified as a higher elevation analog of that association at this time.

**Plots used to describe association (n=5)**
Wieslander: **31, 37, 126, 623, 646**

ECOLOGICAL ZONES V AND VI:
THE EASTSIDE AND WESTSIDE ALPINE

HERBACEOUS ASSOCIATIONS

## *CALAMAGROSTIS PURPURASCENS* HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Purple Reedgrass Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural temperate or subpolar grassland |
| FORMATION | Short alpine or subalpine sod grassland |

The *Calamagrostis purpurascens* herbaceous alliance occurs on high alpine slopes in the Pacific Northwest, east-central Idaho, and California (NatureServe 2007). In the northern portions of its range, it occurs between 2250-2600 m elevation on well-drained soils on sites with early snow melt and high herbaceous cover (NatureServe 2007).

This alliance is represented locally by two associations defined by Taylor (1984). *Calamagrostis purpurascens-Leptodactylon pungens* Herbaceous Vegetation is found in a wide variety of xeric alpine sites at elevations of 9,500-10,600 feet; soils are stony and well drained. *Calamagrostis purpurascens-Ericameria parryi var. monocephala-Leptodactylon pungens* Herbaceous Vegetation has Parry's rabbitbrush present in stands. In addition to these associations, an unclassified alliance-level sample was taken, suggesting further variation. The alliance has been observed on the north and east slopes of Mt. Warren, the west slope of Mt. Lewis, Ellery Lake, and at Mono Pass.

USGS–NPS Veg Data: 99S152 (*Calamagrostis purpurascens* Alliance, Taylor 1984)

### *Calamagrostis purpurascens - Leptodactylon pungens* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Purple Reedgrass - Granite Prickly Phlox Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Calamagrostis purpurascens* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. It has also been observed in Kings Canyon National Park.

**Yosemite and environs**

Known stands of this association are found on Mt. Dana and near Mono, Parker, and Tioga passes.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association grows in a fairly wide variety of xeric alpine habitats. Slopes can be moderate to fairly steep, and aspects are highly variable. Some stands grow in seasonally saturated soils in convex basins, while others are on xeric lower to middle slopes. Soils are stony, well drained, and derived from metamorphic parent material but range in texture from sands to silt loams. Elevations range from 9,500–10,600 feet.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Calamagrostis purpurascens*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Calamagrostis purpurascens*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This highly diverse herbaceous association is characterized by an intermittent canopy of graminoids and forbs with *Calamagrostis purpurascens* (4.6% cover) an important species. *Leptodactylon pungens* (1.25% cover) is diagnostic for this association, and its preferred habitat is well drained stony sites. *Elymus elymoides* (0.75% cover) is a fairly frequent graminoid associate, but at least 13 other graminoids have been recorded in stands at low cover values and frequencies. Traces of cover may be provided by the graminoids *Carex exserta, Achnatherum pinetorum, Calamagrostis canadensis, Carex heteroneura, Carex leporinella, Carex subnigricans, Festuca* spp., and/or *Poa* spp. The most important forbs are *Penstemon davidsonii* (0.38% cover); *Ericameria discoidea* (3.8% cover); *Minuartia nuttallii* (1.25% cover); and traces of *Castilleja nana, Eriogonum ovalifolium,* and/or *Potentilla gracilis.* A few scattered emergent shrubs may be present including krummholz *Pinus albicaulis* and/or *Salix planifolia.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

This association or one very similar has been observed near Kearsarge Pass in Kings Canyon National Park.

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K120, 99S162, 99S163

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***Carex breweri* Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Brewer's Sedge Herbaceous Vegetation** |
| **SYNONYM** | **Brewer Sedge Association (Taylor, 1984)** |
| PHYSIOGNOMIC CLASS | Herbaceous vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine sod grassland |
| ALLIANCE | *Carex breweri* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite (Taylor, 1984). Information about its global range is not available without additional inventory. The species ranges north through the Klamath Mountains of northwestern California to the high mountains of Oregon and Washington (NRCS Plants database 2001).

**Yosemite and environs**
Stands of this association have been sampled at various meadows near the Tioga and Parker passes and at Hall RNA.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite (Taylor, 1984). Soils are sandy, nutrient poor, and well drained. Productivity is low. Additional information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This alpine grassland prefers moderate to steep slopes on northern to western aspects. Elevations range from 10,200–11,200 feet. Stands grow on middle to upper slopes in concave snowbeds with late snowmelt. The soils are stony, sandy loams and well drained. Sites are seasonally saturated by the snowmelt, but summers are dry. These stands must endure several months of drought.

MOST ABUNDANT SPECIES
**Globally**
Herbaceous *Carex breweri* (Taylor, 1984)

**Yosemite and environs**
Herbaceous *Carex breweri*

CHARACTERISTIC SPECIES
**Globally**

Herbaceous *Carex breweri* (Taylor, 1984)

**Yosemite and environs**
Herbaceous *Carex breweri*

VEGETATION DESCRIPTION
**Globally**
This association forms sparse stands dominated by *Carex breweri* (38% cover) (Taylor, 1984). The next most frequent species are *Juncus parryi* (1% cover) and *Cistanthe umbellata* (<1% cover). Additional graminoids that may be present include *Poa glauca* (1% cover), *Carex helleri* (<1% cover), and *Koeleria macrantha* (1% cover). Other forbs that may be present include *Antennaria media* (7% cover).

**Yosemite and environs**
This association forms a patchy sward of graminoids and forbs heavily dominated by *Carex breweri* (31% cover). *Juncus parryi* (1.5% cover) is also important. Other graminoids that may provide a trace of cover include *Trisetum spicatum, Poa fendleriana, Poa stebbinsii, Carex subnigricans, Carex vernacula,* and/or *Calamagrostis breweri. Antennaria media* (4.5% cover) and *Lupinus lepidus* (1% cover) are the most constant forbs. Other common forb associates providing traces of cover may include *Arabis platysperma, Silene sargentii,* and/or *Selaginella watsonii.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably limited to the high central and southern Sierra Nevada.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99K156, 99K160, 99S155, 99K15

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## *CAREX CONGDONII-ARNICA AMPLEXICAULIS* HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Congdon's sedge-Streambank Arnica Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine dry bunch grassland |

Stands of this alliance are characterized by *Carex congdonii,* a medium-sized sedge of scree and boulder fields of the alpine and subalpine zones. Vegetative cover is usually less than 20 percent. This alliance has been observed on the west side of Mt. Dana, the west side of Virginia Pass, and the southwest side of Merced Peak. This alliance is represented by one association, first defined by Taylor (1984), where scattered *Sambucus racemosa* shrubs co-occur with *Carex congdonii*. One association-level sample was collected for the association described by Taylor (1984).

USGS–NPS Veg Data: 99S165 (*Sambucus racemosa/Carex congdonii* Herbaceous Vegetation [Taylor, 1984]), 98K121 (alliance only)

---

## *JUNCUS PARRYI* HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Parry Rush Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine dry bunch grassland |

A *Juncus parryi* herbaceous alliance has been described from Montana where *Erigeron ursinus* codominates with *J. parryi* (NatureServe 2003), and it may extend, in various forms, through high mountain areas of the west. The alliance occurs in late lying snow patch sites on the lee sides of rock outcrops, knolls or ridges away from prevailing southwest and west winds. The growing season is short because the deep snow cover often lasts to midsummer, resulting in cold wet soils. It is represented locally by two associations both defined by Taylor (1984). The two associations are differentiated by soil moisture and length of growing season (Taylor 1984). The *Juncus parryi-Eriogonum incanum* Association is found on the lee sides of large rock outcrops and ridges where forest cover and exposure influence the development of large, late melting snow banks. *Juncus parryi-Phyllodoce breweri* association is usually on snow bed sites where summer soil moisture is higher than *Juncus parryi-Eriogonum incanum* association.

USGS–NPS Veg Data: 98M95 (*Juncus parryi-Phyllodoce breweri* Herbaceous Vegetation [Taylor, 1984]); 99K175, 98M122, 98K89, 98M127, 99K154, 99S150, 308 (*Juncus parryi-Eriogonum incanum* Herbaceous Vegetation [Taylor, 1984])

### *Juncus parryi - Eriogonum incanum* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Parry's Rush - Frosted Buckwheat Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine dry bunch grassland |
| ALLIANCE | *Juncus parryi* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. This alliance includes an alpine snowbed community that was described from the Stony Mountains of southwestern Montana.

**Yosemite and environs**

Stands of this association are found at scattered locations in the alpine zone.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory. The stands described in Montana have elevations ranging from 9,500–10,000 feet. Stands were common near the base of gentle alpine slopes where deep snow accumulates in the winter. Sites are flat to gently sloping, often with southern aspects on the lee side of knolls or ridges away from the prevailing southwest and west wind. The growing season is short because the deep snow cover often lasts to midsummer resulting in cold, wet soils. Soils are shallow, poorly developed clays with the soil surface having high cover of gravel and bare ground (50%).

**Yosemite and environs**

This grassland occurs between 10,000–11,500 feet of elevation on moderate to steep slopes on variable aspects. Soils are well drained sandy loams or silt loams derived from metamorphic parent material. Sites are very stony, averaging 60 percent rock.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Juncus parryi, Eriogonum incanum*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Juncus parryi, Eriogonum incanum*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory. In the stands described in Montana, vegetation in this alliance has a moderately dense herbaceous layer codominated by the perennial graminoid *Juncus parryi* and the perennial forb *Erigeron ursinus*. Common associates include the perennial grasses *Festuca idahoensis* and *Poa glauca* and the forbs *Erigeron peregrinus, Erigeron simplex, Antennaria umbrinella*, and *Lewisia pygmaea*. There is also sparse moss and lichen cover. Adjacent vegetation is typically grasslands dominated by *Festuca idahoensis* and *Potentilla diversifolia*.

**Yosemite and environs**

This grassland is dominated by *Juncus parryi*, which attains 16 percent cover. Total vegetative cover for this association averages only 35 percent. The forb *Eriogonum incanum* (5.6% cover) and the graminoid *Carex exserta* (3% cover) are the only other plants attaining more than a trace of cover. *Poa secunda* (0.7% cover) is a fairly constant graminoid associate. Forbs often associated with this type include *Penstemon heterodoxus, Antennaria media,* and/or *Raillardella argentea.* As many as 40 other species may occur at very low cover and constancy values.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Likely to be fairly widely distributed throughout the High Sierra Nevada but in small stands.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=7)**
USGS–NPS Veg Data: 99K175, 98M122, 98K89, 98M127, 99K154, 99S150
NRI: 308
Taylor (1984): has additional plots from the east side of the study area

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## *CAREX JONESII* TEMPORARILY FLOODED HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Jones Sedge Temporarily Flooded Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous Vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Short alpine or subalpine dry bunch grassland |

Associations from this alliance were not defined due to a lack of plots sampled. Further sampling is required. However, this alliance is usually found in medium tall, moist to wet meadows where *Carex jonesii* is dominant. Typical habitat is meadow edges in ecological Zones III, IV, and VII adjacent to willow thickets dominated by *Salix lemmonii* or *S. eastwoodiae*. *C. jonesii* occurs from Montana and Washington south through Colorado and California. *C. jonesii* is associated, in this alliance, with other ecologically similar herbaceous species including *Glyceria striata* (*G. elata*), *Juncus nevadensis*, *Carex hoodii*, *Mimulus primuloides*, *Viola mackloskyi*, and *Arnica mollis*. One unclassified alliance-level sample was collected.

Potter data: 1006

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## *MINUARTIA NUTTALLII-ERICAMERIA DISCOIDEA* HERBACEOUS ALLIANCE (Taylor 1984)

| | |
|---|---|
| **COMMON NAME** | **Nuttall's Sandwort-Whitestem Goldenbush Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temperate or subpolar perennial forb vegetation |

This alliance is represented locally by one undescribed association. Further sampling is required. Taylor (1984) described a *Minuartia nuttallii* Association as occurring on granitic alpine slopes of the very highest peaks in the Tioga Pass region where soil development is poor and substrates are generally moving gruss or very fine scree. Species diversity is low in this type with the most typical species being *M. nuttallii* and *Arabis lyallii*. One unclassified alliance-level sample was collected.

USGS-NPS Veg Data: 98M126 (alliance level only); 98K85 (*Arenaria kingii compacta-Achnatherum occidentale* Herbaceous Vegetation)

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## OXYRIA DIGYNA HERBACEOUS ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Alpine Sorrel Herbaceous Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |

This alliance is known only from Yosemite. It was originally described from the Hall Research Natural Area and the Tioga Pass region by Taylor (1984). It occurs at high-elevation sites on granitic rock outcrops. Vegetative cover, species diversity and productivity are low. Associated species may include *Saxifraga nidifica*, *Mimulus tilingii*, *Carex vernacular*, *Cystopteris fragilis*, and *Luzula divaricata*. This alliance has been observed on the ridge above Helen Lake and at the head of Lyell Canyon. One association-level sample was collected.

NRI Data: 240 (*Draba lemmonii-Oxyria digyna* Herbaceous Vegetation)

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## *Phlox covillei - (Phlox condensata) - Elymus elymoides - Podistera nevadensis* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Coville's Phlox – Western Bottle-Brush Grass –Nevada Podistera Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |
| ALLIANCE | *Phlox covillei* Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found at scattered locations along the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this alpine association occur on talus slopes and ridgelines at about 11,100 feet of elevation. Slopes are moderate to steep. Aspects are south and west, and sites are probably free of snow early in the season followed by a long, droughty summer. Soils are well drained sands with significant talus or cobble.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Phlox covillei (condensata)*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Phlox covillei, Podistera nevadensis, Elymus elymoides* ssp. *californicus*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This sparse alpine herbaceous vegetation is characterized by a low (< 0.5 meter) open canopy of forbs and graminoids. Thirty-eight species have been recorded in plots of this type. *Phlox covillei* is the dominant forb with 2.5 percent cover. *Arenaria kingii* ssp. *compacta* (0.5% cover) is also usually present. *Podistera nevadensis* is a diagnostic forb, achieving 1.8 percent cover and occurring in 75 percent of stands. *Elymus elymoides* ssp. *californicus* (0.8% cover) is also a constant and the most common graminoid. Other common forb associates may include *Eriogonum ovalifolium* (1.3% cover), *Eriogonum rosense* (0.8% cover), *Castilleja nana* (0.4% cover), *Draba densifolia* (0.4% cover), *Ericameria parryi* var. *monocephala* (4.4% cover), *Astragalus whitneyi* var. *whitneyi* (0.75% cover), *Astragalus purshii* var. *lectulus* (0.25% cover), *Erigeron compositus* (0.25% cover), and/or *Erigeron pygmaeus* (0.25% cover). Graminoids present commonly include *Poa glauca* ssp. *rupicola* (0.4% cover), *Achnatherum pinetorum* (0.25% cover), *Carex tahoensis* (0.25% cover), and/or *Festuca brachyphylla* ssp. *brachyphylla* (0.25% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Likely to be limited to the High Sierra Nevada in small stands.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: *Phlox covillei* has been synonymized by some authors with *Phlox condensata* (including Jepson manual), a species considered to be largely of the eastside pine and pinyon woodland belt in California. The predominant species in this association is probably *Phlox covillei*, however at lower elevations in the subalpine the similar *Plox diffusa* may be present.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K118, 98M119, 98M120, 98M121

## *Phlox covillei - Elymus elymoides - Podistera nevadensis - Erigeron pygmaeus* Herbaceous Vegetation

| | |
|---|---|
| **COMMON NAME** | **Nevada Podistera - Bottlebrush Squirreltail - Pygmy Fleabane Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial forb vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar perennial forb vegetation |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Low temperate or subpolar perennial forb vegetation |
| ALLIANCE | Phlox covillei - Elymus elymoides Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found at scattered locations along the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this alpine association occur on talus slopes and ridgelines at between 11,500–12,500 feet of elevation. Slopes are moderate to steep. Aspects are south and west, and sites are probably free of snow early in the season followed by a long, droughty summer. Soils are well drained and gravelly with significant talus, scree, or cobble.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Festuca brachyphylla* ssp. *brachyphylla, Podistera nevadensis, Phlox pulvinata*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Herbaceous *Elymus elymoides* ssp. *californicus, Podistera nevadensis*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This sparse alpine herbaceous vegetation is characterized by a low (< 0.5 meter) open canopy of forbs and graminoids. *Podistera nevadensis* is a diagnostic forb, achieving 0.4 percent cover and occurring in 75 percent of stands. *Elymus elymoides* ssp. *californicus* (0.1% cover) is also diagnostic and one of the most common graminoids. Other common forb associates may include *Phlox pulvinata* (0.4% cover), *Eriogonum ovalifolium* (0.2% cover), *Selaginella watsonii* (0.2% cover), *Draba densifolia* (0.07% cover), *Astragalus kentrophyta* (0.1% cover), and/or *Erigeron pygmaeus* (0.13% cover). Graminoids present commonly include *Festuca brachyphylla* ssp. *brachyphylla* (0.06% cover) and/or *Poa glauca* ssp. *rupicola* (0.06% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: *Phlox covillei* has been synonymized by some authors with *Phlox condensata*, a species considered to be largely of the eastside pine and pinyon woodland belt in California.

**Plots used to describe association (n=8)**
NRI: 217, 255, 294, 295, 297, 313, 306, 307

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***Pentaphylloides floribunda*/*Danthonia intermedia* Herbaceous Vegetation [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Shrubby cinquefoil/Timber Oatgrass Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold-deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Medium-tall temperate or subpolar grassland with a sparse cold-deciduous shrub layer |
| ALLIANCE | Pentaphylloides Floribunda Shrub Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of *Pentaphylloides floribunda*/*Danthonia intermedia* herbaceous vegetation are sampled in the mapping area of Yosemite and environs within the Dunderberg Peak and Koip Peak 7.5 minute topographic quadrangles.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pentaphylloides floribunda /Danthonia intermedia* herbaceous vegetation are found at mesic sites at high elevation (9,850–11,120 feet) on low, mid to upper portions of generally linear to undulating, moderate to steep (>10 degrees) slopes. Exposures are variable ranging from north to east to south. These sites are usually found on ridges and bedrock outcrops. Soils tend to be poorly developed, rapidly to well-drained loam (loamy sand to silt loam) from metamorphic parent materials. The amount of bedrock ranges from 20-30%, other rock cover adds an additional 30-40% cover, with leaf litter contributing 20-30% cover. Wood is scarce on these sites, and bare soil exposure may be up to 20 percent.

MOST ABUNDANT SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Pentaphylloides floribunda* |
| Herbaceous | *Poa glauca, Carex exserta, Selaginella watsonii* |

CHARACTERISTIC SPECIES

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Pentaphylloides floribunda* |
| Herbaceous | *Danthonia intermedia* |

VEGETATION DESCRIPTION

**Globally**

This association has been described only from Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of *Pentaphylloides floribunda /Danthonia intermedia* herbaceous vegetation form an open shrub layer with a mixed herbaceous dicot and grass understory. *Pentaphylloides floribunda* dominates stands in stature with 22% mean cover. Danthonia intermedia provides little cover (1.8%) but is a consistent component. Other important species include *Poa glauca* (15%), *Carex exserta* (15%), and *Selaginella watsonii* (8.7%). Other species with high frequency but low cover include *Elymus elymoides, Muhlenbergia richardsonis and Trisetum spicatum*, Other species that may occasionally be found in the stands include *Pyrrocoma apargioides, Elymus trachycaulus, Antennaria rosea* and *Rhodiola integrifolia ssp. integrifolia* (*Sedum roseum*). *Gentianella tenella* ssp. *tenella*. is a rare species that may be found in this association.

OTHER NOTEWORTHY SPECIES

*Gentianella tenella ssp. tenella* is a Park Sensitive (Special Status Vascular Plant Species List for YNP-2003) species found in one of the three plots. This is a circumpolar species that occurs in the central and southern Sierra Nevada (Tuolumne and Tulare counties), the White and Inyo mountains (Mono and Inyo counties) and north (Siskiyou County). It is usually found in open, wet areas between 3,200 – 3,900 m in subalpine forests or alpine fell-fields. It is documented from only two locations in Yosemite National Park.

CONSERVATION RANK G4?

| | |
|---|---|
| RANK JUSTIFICATION | Probably of somewhat limited distribution at high elevations in the Sierra Nevada and Cascade Mountains and possibly in the White Mountains and the Klamath Range. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K124, 99K133, 99K152

(SUB)SHRUB/SCRUB ASSOCIATIONS OF ZONES V AND VI

***Artemisia rothrockii/Monardella odoratissima* Dwarf-shrubland**

| | |
|---|---|
| **COMMON NAME** | **Timberline Sagebrush/Mountain Monardella Dwarf-Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Extremely xeromorphic evergreen dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Extremely xeromorphic evergreen subdesert dwarf-shrubland |
| ALLIANCE | *Artemisia rothrockii* Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. Anecdotal information suggests that this association or at least the alliance may range from the northern to the southern High Sierra (Sawyer and Keeler–Wolf 1995).

**Yosemite and environs**

Stands of this association are found near seeps and streams east of the Sierra Crest within the project environs.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this vegetation are found between 8,700–10,200 feet of elevation on varied slopes and aspects but largely southerly facing. Stands are near seeps or streams with perennial moisture. Soils are gravelly silt loams to loamy sands and often carbonate-rich.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Artemisia rothrockii*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Artemisia rothrockii*

VEGETATION DESCRIPTION

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This dwarf-shrubland is heavily dominated by *Artemisia rothrockii* with 45 percent–66 percent cover. The only shrubs that co-occur in this association are *Symphoricarpos rotundifolius*, with only 33 percent constancy and 1 percent cover, and both *Ribes montigenum* and *Holodiscus discolor* each at 17 percent constancy and less than 1 percent cover. On a single plot a *Salix* sp. covered about 20 percent. Graminoids dominate the open herbaceous layer, and species composition may be highly variable between stands. *Carex exserta (C. filifolia* var. *erostrata*) (13% cover), *Danthonia intermedia* (0.3% cover), and/or *Poa wheeleri* (5% cover) are the most common graminoid associates. Forbs only total a small amount of cover in this association, typified by the diagnostic forb *Monardella odoratissima* (0.8% cover). Other forbs that are often present at very low cover values may include *Antennaria rosea*, *Penstemon rydbergii*, *Juncus* sp., and/or *Horkelia fusca*. Twenty-five other species have been recorded on plots of this association, but none achieve more than 30 percent constancy. The forb *Castilleja miniata* and the graminoid *Poa wheeleri* each achieve 5 percent cover in 30 percent of plots. All other recorded species (mostly graminoids) only contribute a trace to the overall cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Probably endemic to the central and southern High Sierra Nevada and perhaps the high Transverse Ranges of California. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**
*Artemisia rothrockii* is endemic to California.

**Yosemite and environs**
This association is currently placed in the wrong portion in the USNVC hierarchy. It should be placed with microphyllous dwarf-shrubland vegetation, as it is not extremely xeromorphic.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99S126, 99S128, 98M74

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*Salix arctica* - *Calamagrostis breweri* - *Vaccinium caespitosum* - *Antennaria media* Dwarf-Shrubland

| | |
|---|---|
| **COMMON NAME** | **Arctic Willow - Shorthair Reedgrass - Dwarf Bilberry - Stony Mountain Pussytoes Dwarf-Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Creeping or matted cold deciduous dwarf-shrubland |
| ALLIANCE | *Salix arctica* Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association grows near lakes and streams in alpine regions east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found near seeps, streams, or lakes between 10,000–11,200 feet of elevation. Soils are seasonally saturated silt loams and clay loams derived from igneous and metamorphic parent materials. Slopes are gentle to moderate, and stands prefer basins as well as lower and sometimes middle slope positions. Aspects are generally north and east.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix arctica* |
| Herbaceous | *Calamagrostis breweri* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Salix arctica* |
| Herbaceous | *Antennaria media, Calamagrostis breweri* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This vegetation forms a low, intermittent canopy less than 0.5 meter in height. Graminoids tend to be emergent over the low, mat-forming dominant shrub species *Salix arctica* (26% cover). *Vaccinium caespitosum* (9.5% cover) and *Kalmia polifolia* (7.5% cover) complete the subshrub "canopy." Forbs provide a little cover, primarily *Antennaria media* (3.2% cover), *Castilleja lemmonii* (0.4% cover), *Oreostemma alpigenum* var. *alpigenum* (2.1% cover), *Luzula congesta* (0.5% cover), *Potentilla drummondii* (0.9% cover), and/or *Gentiana newberryi* (0.2% cover). Many graminoid species are present, mostly *Carex* and *Juncus* species. The most common graminoids are *Trisetum spicatum* (0.8% cover), the diagnostic graminoid *Calamagrostis breweri* (8% cover), and/or *Juncus parryi* (0.2% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Probably widespread in the Sierra Nevada alpine but of limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
These stands are ecologically closely related to some stands of *Calamagrostis breweri* and *Vaccinium caespitosum* alliances. Further analysis will probably suggest a moist/wet alpine turf ecological group that will include these and other associations from other alliances.

**Plots used to describe association (n=9)**
USGS–NPS Veg Data: 98K91, 98M114, 98M129, 98M92, 99K155, 99S140, 99S156, 99S160, 98M130

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## *SALIX* (*RETICULATA, NIVALIS*) DWARF-SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **(Net-viened Willow, Snow Willow) Dwarf-Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Creeping or matted cold deciduous dwarf-shrubland |

This alliance occurs on rocky alpine slopes and flats between 1950 and 2400 m (NatureServe 2007). It occurs in the North Cascades Range in Washington, the Sierra Nevada of California, and the Rocky Mountains of Colorado. In the Cascades and Rockies, snow melt is early in the season (May to June). *Salix nivalis*, a mat-forming, alpine sub-shrub, typically contributes high cover. Across this range, associated species include *Festuca brachyphylla*, *Carex scirpoidea*, and *Lupinus lepidus*.

Locally, this alliance has been observed east of the Sierra Nevada crest (and closely adjacent to the crest on the west slope) on rocky, metamorphic substrates with late-lying snow between 3175 and 3500 m. Associated species included *Salix arctica*, *Potentilla drummondii* ssp. *breweri*, and *Carex filifolia*. Associations from this alliance were not defined in this project due to an insufficient number of stands. One unclassified alliance-level sample was taken. Further sampling is required.

USGS–NPS Veg Data: 99S157

ECOLOGICAL ZONES VII AND VIII: THE EASTSIDE FORESTS, WOODLANDS, AND SCRUBS

HERBACEOUS VEGETATION

***Juncus balticus* – (*Juncus mexicanus*) Herbaceous Vegetation**

| | |
|---|---|
| **COMMON NAME** | **Baltic Rush - Mexican Rush Herbaceous Vegetation** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Herbaceous vegetation |
| PHYSIOGNOMIC SUBCLASS | Perennial graminoid vegetation |
| PHYSIOGNOMIC GROUP | Temperate or subpolar grassland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| PHYSIOGNOMIC FORMATION | Seasonally flooded temperate or subpolar grassland |
| ALLIANCE | *Juncus balticus* Seasonally Flooded Herbaceous Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association has been documented from scattered locations throughout the park and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association have been found from 4,200–9,500 feet of elevation in seasonally flooded valley bottoms and meadows. Slopes are flat to very gentle, and stands can occur on all aspects. Soils are moderately to poorly drained loams, loamy sand, or clay loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Juncus balticus*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Herbaceous *Juncus balticus, Juncus mexicanus*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This seasonally flooded perennial grassland is dominated by *Juncus balticus* (34% cover), with *Juncus orthophyllus* (17% cover) and *Juncus mexicanus* (10% cover) important species. *Poa pratensis* (6% cover) is also usually present. Forbs are sparse but fairly diverse. *Achillea millefolium* (0.5% cover), *Iris missouriensis* (1% cover), and/or *Taraxacum officinale* (1% cover, exotic) have the highest frequency, though *Mimulus primuloides* (12.5% cover) may be abundant in some stands. Total vegetative cover for this association often exceeds 80 percent, and the canopy is usually less than 0.5 meter in height.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
A grazing-tolerant vegetation, this association is resistant to repeated heavy grazing along eastside creeks and meadows.

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 98K55, 98K57, 98M28, 98M57, 99K78, 98M87

SHRUB/SCRUB ASSOCIATIONS OF ECOLOGICAL ZONES VII AND VIII

***Ceanothus velutinus - Prunus emarginata - Artemisia tridentata* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Snowbrush Ceanothus-Bitter Cherry-Big Sagebrush Shrubland** |
| **SYNONYM** | **Snowbrush Ceanothus Series (in part)** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Temperate broad-leaved evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural /Seminatural |
| FORMATION | Sclerophyllous temperate broad-leaved evergreen shrubland |
| ALLIANCE | *Ceanothus velutinus* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. The alliance is widespread in western North America.

**Yosemite and environs**

Stands of this association are found in the montane regions of the park east of the Sierra Nevada crest including Lundy Canyon, Lee Vining Canyon, and Virginia Lakes Basin.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

The seven known stands of this association are found from 7,200–8,600 feet elevation. Stands are on steep midslopes on loamy sands derived from granitic rocks. Aspects are northeast, east, and southeast. These stands tend to occur on the lee of ridges or concavities, perhaps where more snow accumulates than is the mode for the area.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Ceanothus velutinus*

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Shrub *Ceanothus velutinus, Prunus emarginata, Artemisia tridentata*

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is characterized by a continuous canopy between 1–2 meters in height. *Ceanothus velutinus* (62.5% cover) and *Prunus emarginata* (20% cover) are the dominant shrub species. Several other shrub species may be present at very low cover values. These include *Symphoricarpos rotundifolius* (1.25% cover), *Artemisia tridentata, Eriogonum umbellatum,* and/or *Eriogonum elatum* (all 0.5% cover). The herbaceous layer is diverse but sparse. Common herbaceous associates include *Phacelia ramosissima, Crepis acuminata, Cryptantha echinella, Gayophytum ramosissimum, Lupinus argenteus, Monardella odoratissima, Wyethia mollis,* and/or *Osmorhiza occidentalis*. Scattered graminoids are present at very low cover values and may include *Elymus elymoides, Elymus trachycaulus, Achnatherum occidentale, Bromus carinatus,* and/or *Melica stricta.*

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Generally small stands that are widely scattered. Probably limited to the east slope of the Sierra Nevada. |
| DATABASE CODE | To be determined |

COMMENTS

**Globally**

**Yosemite and environs**

Note: This association includes the former Ceanothus velutinus - Artemisia tridentata/Wyethia mollis association from the preliminary classification. Most stands of this alliance are known to respond to fire by prolific reseeding, in some cases emerging from a seed bank after many years. The local stands on the east side of the crest are probably no less dependent on fire even though the surrounding Artemisia and Purshia scrubs are not fire dependent. These local stands appear to favor mesic, snow-accumulating microsites where they are able to persist and form seed banks from which they do spring forth after the occasional fires in the sagebrush zone.

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 99K67, 99K74, 99K79, 98M54, 99S66, 99S70

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*Artemisia cana/Iris missouriensis - Juncus balticus* Shrubland [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Silver Sagebrush/Stony Mountain Iris - Baltic Rush Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded microphyllous shrubland |
| ALLIANCE | *Artemisia cana* Temporarily Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. Some ecological types described by Weixelman et al. (1999) from the east slope of the Sierra closely resemble this association. *Artemisia cana* is a widespread species of temporarily or seasonally flooded settings in the intermountain west.

**Yosemite and environs**

Stands of this alliance are found in scattered locations to the east of the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

Plant associations in this alliance occur at middle elevations (3,000–8,200 [occasionally to 9,800] feet). Precipitation varies across the range from less than 25 centimeters in semiarid basins of the western Great Basin to over 90 centimeters in moister meadow habitats of the Sierra Nevada and northern Stony Mountains. Most commonly, this alliance occurs on alluvial fans or alluvial terraces along mountain streams where soils are saturated in spring and water tables remain within
2–3 meters of the soil surface all year. In general, these communities show an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils are typically formed in alluvium and have textures of silt loams and sandy loams. Adjacent vegetation varies from *Pinus contorta* forests in the mountains to *Artemisia tridentata* shrublands in semiarid basins and plains, to *Salix* spp. shrublands on terraces above riparian habitats. The hydrological divisions in the *Artemisia cana* group are poorly distinguished. In montane and subalpine meadows and valleys *Artemisia cana* plant associations are often the driest of the recognizable riparian habitats. This transitional position and the broad floodplains where these shrublands typically occur blur wetland/upland distinctions. Sarr (1995) noted two contiguous *Artemisia cana* communities in the Sierra Nevada that appeared to be upland and facultative wetland types based on habitat affinities of the understory layer. Most of these riparian stands have been placed in the *Artemisia cana* temporarily flooded shrubland alliance (A.843). Although these sites generally have seasonally saturated soils and shallow water tables, the true frequency of flooding is probably highly variable. Nearly all *Artemisia cana* communities are azonal (after Daubenmire 1970) and are associated with sites of above normal soil moisture.

**Yosemite and environs**

Stands of this association occur between 7,900–8,600 feet of elevation on gentle lower slopes or basin floors. Sites are seasonally or temporarily flooded. Soils are silty loams.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia cana* |
| Herbaceous | *Iris missouriensis, Juncus balticus* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia cana* |
| Herbaceous | *Iris missouriensis, Juncus balticus* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

*Artemisia cana* dominates this association with 38 percent cover, forming an open canopy less than 0.5 meter in height. The herbaceous understory is dominated by *Iris missouriensis* (26% cover) with the graminoid *Juncus balticus* an important component (7.7% cover). Total herbaceous cover is quite high and roughly split between forbs and graminoids. Other forbs usually occur at low cover values (0.5%) and may include *Achillea millefolium, Arnica longifolia, Arnica parryi, Gayophytum diffusum, Navarretia breweri,* and/or *Potentilla glandulosa*. The graminoid species that may be present include *Poa pratensis* (7.5% cover), *Poa secunda, Carex praegracilis, Achnatherum lemmonii, Leymus triticoides, Elymus trachycaulus,* and/or *Agrostis variabilis.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

Vegetation in this alliance is distinguished from the *Artemisia cana* shrub herbaceous alliance by the greater cover of shrubs (> 25% canopy cover) and the more regular flooding regime.

**Yosemite and environs**

This association signifies the repeated disturbance these sites have had from grazing and browsing of livestock. Both *Iris missouriensis* (poisonous to livestock) and *Juncus balticus* and/or *Juncus mexicanus* are indicators of heavily grazed palustrine areas.

**Plots used to describe association (n=2)**

USGS–NPS Veg Data: 99K88, 99S94

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## *ARTEMISIA ARBUSCULA* SSP. *ARBUSCULA* DWARF-SHRUBLAND ALLIANCE

| | |
|---|---|
| **COMMON NAME** | **Low Sagebrush Dwarf-Shrubland Alliance** |
| **SYNONYM** | **Subalpine Upland Shrub Habitat (in part)** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Needle-leaved or microphyllous evergreen dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Caespitose needle-leaved or microphyllous evergreen dwarf-shrubland |

The *Artemisia arbuscula* Dwarf-shrubland Alliance was observed locally east of the Sierra crest between 2350 and 3200 m on gentle to steep slopes with stony soils. Aspects varied but slopes were typically very exposed to wind and weathering. Important associated species included *Leptodactylon pungens*, *Eriogonum microthecum*, *Elymus elymoides*, *Eriogonum* spp., and *Chrysothamnus viscidiflorus*. This alliance is represented locally by two associations both newly defined in this project. They are arranged along an elevation or temperature gradient from higher elevation, cooler sites (*Artemisia arbuscula/Leptodactylon pungens* Association) to lower, warmer sites (*Artemisia arbuscula/Eriogonum microthecum* Association). Both associations have high wind exposure. In addition to these associations one unclassified alliance-level sample was taken, suggesting further variation.

USGS–NPS Veg Data: 99S125

*Artemisia arbuscula/Leptodactylon pungens* Dwarf-shrubland [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Gray Low Sagebrush/Granite Prickly Phlox Dwarf-Shrubland** |
| **SYNONYM** | **Subalpine Upland Shrub Habitat (in part)** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Needle-leaved or microphyllous evergreen dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Caespitose needle-leaved or microphyllous evergreen dwarf-shrubland |
| ALLIANCE | *Artemisia arbuscula* ssp. *arbuscula* Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

Similar associations are known from the subalpine regions of the Cascades, Warner Mountains, White, Inyo, and Sweetwater ranges in addition to the Sierra Nevada.

**Yosemite and environs**

This association is known from scattered locations throughout the eastern subalpine regions of the park and environs east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

Similar associations prefer dry slopes and summits on talus or shallow soils between 5,900–11,800 feet of elevation.

**Yosemite and environs**

Stands of this association are found between 9,200–10,300 feet of elevation on gentle to moderate middle to upper slopes. Aspects are mostly southeast to southwest but on flatter sites may be variable. Soils are sands to silt loams, stony and derived from metamorphic parent material.

MOST ABUNDANT SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Artemisia arbuscula, Ericameria discoidea, Leptodactylon pungens, Ribes cereum* |
| Herbaceous | *Ipomopsis congesta* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* ssp. *arbuscula* |

CHARACTERISTIC SPECIES

**Globally**

| | |
|---|---|
| Shrub | *Artemisia arbuscula, Leptodactylon pungens* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* ssp. *arbuscula, Leptodactylon pungens* |

VEGETATION DESCRIPTION

**Globally**
This association has scattered shrubs emergent over an open ground layer composed of subshrubs, forbs, and graminoids. The canopy is less than 1 meter in height. *Artemisia arbuscula* ssp. *arbuscula* is an important to dominant species. The subshrubs *Ericameria discoidea, Leptodactylon pungens,* and/or *Ribes cereum* may also be present along with the forb *Ipomopsis congesta.* Other common associates may include *Vaccinium caespitosum, Phlox pulvinata, Carex congdonii, Danthonia unispicata, Arabis lemmonii, Podistera nevadensis, Calamagrostis purpurascens, Holodiscus discolor, Sambucus racemosa* ssp. *racemosa, Artemisia rothrockii,* and/or *Stenotus acaulis.*

**Yosemite and environs**
This dwarf-shrubland has an open canopy dominated by *Artemisia arbuscula* ssp. *arbuscula* (16.8% cover) with an understory of *Leptodactylon pungens* (2% cover). A trace of *Chrysothamnus viscidiflorus* is also sometimes present in the shrub layer. The herbaceous understory may be very diverse though sparse. The most common forbs present may include *Packera cana (= Senecio canus), Astragalus purshii* var. *lectulus, Castilleja applegatei, Crepis acuminata,* and/or *Erigeron clokeyi. Elymus elymoides* is the most common graminoid (0.25% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?

RANK JUSTIFICATION This is probably a widespread type in the intermountain west.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Stands are locally restricted to the upper limits of the sagebrush zone on the east side of the crest. Stands are usually small "islands" surrounded by larger stands of *Artemisia tridentata* or *Purshia tridentata* alliance stands.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K54, 98M111, 98M80, 99K64

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*Artemisia arbuscula* - *Eriogonum microthecum* Dwarf-shrubland [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Gray Low Sagebrush-Slender Wild Buckwheat Dwarf-Shrubland** |
| **SYNONYM** | **Subalpine Upland Shrub Habitat (in part)** |
| PHYSIOGNOMIC CLASS | Dwarf-shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen dwarf-shrubland |
| PHYSIOGNOMIC GROUP | Needle-leaved or microphyllous evergreen dwarf-shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Caespitose needle-leaved or microphyllous evergreen dwarf-shrubland |
| ALLIANCE | *Artemisia arbuscula* ssp. *arbuscula* Dwarf-shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |
| RANGE | |

**Globally**
Stands of this alliance are found in scattered locations throughout the subalpine and intermontane basin regions of Oregon, California, Idaho, and Nevada. This association is only known locally in the Yosemite region.

**Yosemite and environs**
This association has been described from subalpine locations outside the park, east of the Sierra Nevada crest, largely in the Virginia Lakes and Bridgeport Valley areas.

ENVIRONMENTAL DESCRIPTION
**Globally**
The vegetation in this alliance is best represented in cold, dry areas of the intermountain west between 3,300 and 12,500 feet in elevation. Precipitation ranges from 20–50 centimeters (150) annually, with a large proportion falling as winter snow. Soils are usually shallow, stony clays, often with an impenetrable layer at less than 60 centimeters depth. Poor drainage often leads to mounded water tables in the spring, which may control the distribution of this vegetation. Poor drainage may explain the occurrence of patches of *Artemisia arbuscula* dwarf-shrublands in *Pinus ponderosa* woodlands or *Artemisia tridentata* shrublands. This association may also be adjacent to *Juniperus* - *Pinus* woodlands, *Artemisia nova* shrublands, or *Cercocarpus ledifolius* woodlands.

**Yosemite and environs**
Stands of this association are found between 7,700–9,200 feet of elevation on gentle to steep slopes. Aspects are generally north, but may be variable on flatter sites. Soils are stony sands to silt loams derived from igneous or metamorphic parent materials. Precipitation ranges from 20–50 centimeters (150) annually, with a large proportion falling as winter snow.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* |
| Herbaceous | *Festuca idahoensis, Pseudoroegneria spicata* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* ssp. *arbuscula* |
| Herbaceous | *Festuca idahoensis, Pseudoroegneria spicata* |

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia arbuscula* ssp. *arbuscula, Eriogonum microthecum* |
| Herbaceous | *Koeleria macrantha* |

VEGETATION DESCRIPTION
**Globally**
*Artemisia arbuscula* is the dominant shrub, generally occurring with high constancy and 8–20 percent cover. Other shrub associates include *Artemisia tridentata, Chrysothamnus viscidiflorus, Gutierrezia sarothrae,* and/or *Purshia tridentata*. The herbaceous layer is typically of perennial grasses. Grasses often form the upper vegetation stratum and are often of greater cover than the shrub layer. Widespread and characteristic grass species include *Festuca idahoensis* and *Pseudoroegneria spicata*, which occur in stands from Oregon to Montana. More localized but important grass associates include *Elymus elymoides, Poa secunda, Koeleria macrantha, Achnatherum hymenoides,* and *Hesperostipa comata*.

**Yosemite and environs**
Stands near Yosemite are dominated by *Artemisia arbuscula* ssp. *arbuscula* (15% cover) with traces of *Eriogonum microthecum. Chrysothamnus viscidiflorus* is also usually present at about 1 percent cover. The open herbaceous layer is dominated by perennial grasses, primarily *Elymus elymoides* (1.6% cover) and *Koeleria macrantha* (1.6% cover). Other common graminoid associates may include (in order of decreasing cover and constancy)

*Achnatherum hymenoides, Poa secunda*, and/or *Achnatherum pinetorum.* A variety of forbs is present at low cover levels and constancy. The most common forb associates include *Stephanomeria spinosa, Astragalus purshii*, and/or *Leptodactylon pungens.* The height of this association is usually less than 0.5 meter, with the graminoids often taller than the shrubs and forbs.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2G3?

RANK JUSTIFICATION Stands of this alliance are known from many locations in the western United States, but this association may be localized in trans-Sierran California.

DATABASE CODE CEGL001411?

COMMENTS
**Globally**

**Yosemite and environs**
This association is usually found at lower elevations on fine-grained soils than the previously described *Artemisia arbuscula/Leptodactylon pungens* association.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99K91, 99K92, 99S67

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**ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE**

| | |
|---|---|
| **COMMON NAME** | **Big Sagebrush Shrubland Alliance** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |

This broadly distributed alliance is found in the western United States on dry steppes (NatureServe 2007). Shrubs are conspicuous in this alliance, but herbaceous species usually have equal or greater coverage. The shrub stratum is typically 0.3-0.7 m tall. In the National Vegetation Classification, this is a very broadly defined alliance, containing associations dominated by one of any subspecies of *Artemisia tridentata*: ssp. *tridentata*, ssp. *vaseyana*, and ssp. *wyomingensis*. The Yosemite classification treats *Artemisia tridentata* ssp. *vaseyana* shrubland alliance separately.

The big sagebrush alliance is represented locally by two associations both newly defined in this project. Both are insufficiently sampled and require more sampling for verification. This alliance has been observed in the lower portions of Lee Vining, Lundy, and Green Creek canyons.

USGS–NPS Veg Data: 99K62 (*Artemisia tridentata* ssp. *tridentata-Ericameria nauseosa* Shrubland); 99S72, 99S79 (*Artemisia tridentata* spp. *tridentata/Achnatherum hymenoides* Shrubland)

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***Artemisia tridentata* ssp. *tridentata/Achnatherum hymenoides* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Basin Big Sagebrush/Indian Ricegrass Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Artemisia tridentata* ssp. *tridentata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association is found in the Great Basin scrub zone east of the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found on gentle slopes between 7,300–7,700 feet of elevation. Aspects are north and east, and stands prefer toeslopes and basin floor topographic positions. Soils are well drained loamy sands to silty loams derived from igneous or metamorphic parent materials.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *tridentata* |
| Herbaceous | *Achnatherum hymenoides* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *tridentata* |
| Herbaceous | *Achnatherum hymenoides* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This vegetation type forms an open to intermittent canopy between 1–2 meters of height heavily dominated by *Artemisia tridentata* ssp. *tridentata* (50% cover). The graminoid *Achnatherum hymenoides* dominates the understory with 7.75 percent cover. Other subshrub associates that may be present at very low cover values (0.25%) include *Chrysothamnus viscidiflorus, Ericameria nauseosa,* and/or *Purshia tridentata. Achnatherum nevadense* and *Leymus cinereus* usually occur at 0.5 percent cover, and other occasional graminoid associates may include *Bromus tectorum* (exotic, 0.2% cover) and/or *Hesperostipa comata* (0.2% cover). Forbs are very sparse and may include trace amounts of *Cryptantha echinella, Gayophytum diffusum, Lupinus argenteus,* and/or *Tiquilia* sp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: This association is poorly described and requires more samples before a good formal description should be accepted. Currently appears to be a sandy, deep soil type compared to other stands of *Artemisia tridentata* in the mapping area.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99S72, 99S79

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***Artemisia tridentata* ssp. *vaseyana/Monardella odoratissima* Shrubland** [Provisional]

| | |
|---|---|
| **COMMON NAME** | **Mountain Big Sagebrush/Mountain Monardella Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
All the documented stands of this association occur at relatively high elevations in Virginia Canyon.

ENVIRONMENTAL DESCRIPTION

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association grows on moderate to steep west-facing slopes. Stands are concentrated at about 10,000 feet of elevation.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *vaseyana* |
| Herbaceous | *Monardella odoratissima* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* ssp. *vaseyana* |
| Herbaceous | *Monardella odoratissima* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is dominated by an open canopy of *Artemisia tridentata* ssp. *vaseyana* (7% cover), with *Spiraea splendens* var. *splendens* (0.8% cover) as an occasional associate. The herbaceous layer is sparse but diverse. *Monardella odoratissima* is the dominant and diagnostic forb but only achieves 0.5 percent cover. *Erysimum capitatum* var. *perenne* and *Phacelia mutabilis* are also often present at about 0.1 percent cover. Several graminoids are represented in trace amounts in the herbaceous layer including *Elymus elymoides*, *Melica bulbosa*, *Bromus suksdorfii*, and/or *Achnatherum pinetorum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
More locations need to be found for this association. The stands occur at around 10,000 feet elevation and are adjacent to subalpine forest stands of *Pinus contorta* or *Pinus albicaulis*. Note: These samples were taken before subspecies of *Artemisia tridentata* were well recognized in California. These are probably *Artemisia tridentata* ssp. *vaseyana* stands but some uncertainty remains.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 53, 225, 259

***Purshia tridentata - Artemisia tridentata - Tetradymia canescens* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Antelope Bitterbrush - Big Sagebrush - Spineless Horsebrush Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Purshia tridentata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is currently known from scattered locations east of the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association typically grows on lower slopes that vary from gentle to steep. Aspects are south and east, and elevations range from 6,800–7,900 feet. Soils are sand to silt loams derived from igneous or metamorphic rocks.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Artemisia tridentata* ssp. *tridentata*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Artemisia tridentata* ssp. *tridentata, Purshia tridentata, Tetradymia canescens*

VEGETATION DESCRIPTION

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is characterized by an intermittent shrub canopy codominated by *Artemisia tridentata* ssp. *tridentata* (31% cover) and *Purshia tridentata* (16% cover), with a small amount of *Tetradymia canescens* (1% cover). The canopy is generally less than 1 meter in height. Trace amounts of several herbaceous species may be present, primarily *Lupinus argenteus* (0.3% cover), *Phacelia ramosissima* (0.3% cover), *Castilleja applegatei* (0.2% cover), and/or *Balsamorhiza sagittata* (0.5% cover). Many graminoid species also provide trace amounts of cover. These may include *Elymus elymoides*, *Achnatherum hymenoides*, *Bromus tectorum* (exotic), *Hesperostipa comata*, and/or *Leymus cinereus.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note that these descriptions linking the mixed *Artemisia tridentata* and *Purshia tridentata* plots with *Purshia tridentata* Alliance is substantiated by TWINSPAN and cluster analysis. The general rule for membership in the *Purshia tridentata* Alliance used in the USNVC states dominance by *Purshia* as the criteria (NatureServe 2001).

**Plots used to describe association (n=7)**
USGS–NPS Veg Data: 98K38, 98K45, 99S82, 99S62, 99S63, 99S76, 99S87

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***Purshia tridentata - Artemisia tridentata/Achnatherum hymenoides* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Antelope Bitterbrush – Big Sagebrush/Indian Ricegrass Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Purshia tridentata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is known from several locations near Mount Dana to the east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found between 6,500–7,800 feet of elevation on northeast to southeast aspects. Slopes vary from flat to somewhat steep, and stands prefer lower slope positions. Soils are loamy sand to sandy loam, usually derived from granitic rock.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Purshia tridentata, Artemisia tridentata* |
| Herbaceous | *Achnatherum hymenoides* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This vegetation is characterized by an open to intermittent short-shrub canopy between 0.5–1 meter in height. *Artemisia tridentata* (38% cover) and *Purshia tridentata* (7% cover) codominate, with trace amounts of *Chrysothamnus viscidiflorus* and *Prunus andersonii* often present. The herbaceous layer is sparse and dominated by graminoids. *Achnatherum hymenoides* is characteristic but averages only about 1–2 percent cover. Two forbs, *Gayophytum ramosissimum* and *Lupinus argenteus,* are often present in trace amounts. *Bromus tectorum* (exotic) is the most common graminoid contributing nearly 2 percent cover. Other common graminoids in order of declining importance include *Elymus elymoides, Leymus cinereus,* and/or *Achnatherum speciosum.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
*Purshia tridentata/Achnatherum hymenoides* shrubland (CEGL001058) in the USNVC is very similar to this association, though the environmental descriptors vary.

**Yosemite and environs**
The presence of *Achnatherum hymenoides* suggests a sandy substrate compared to other stands of this alliance in the area.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98M40, 98M42, 99K60, 98K37

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***Purshia tridentata - Artemisia tridentata/Achnatherum nevadense - (Achnatherum nelsonii* ssp. *dorei)* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Antelope Bitterbrush - Big Sagebrush/Nevada Needlegrass - (Dore's Needlegrass) Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Purshia tridentata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are only known from the Lundy quad area, along the Virginia Lakes Road, east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
The known stands of this association are found at 8,500–8,600 feet elevation on north to east aspects. Stands prefer moderate to steep upper slopes. The soils are well drained loamy sands derived from metamorphic or igneous rocks.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Achnatherum nevadense, Elymus elymoides* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Shrub | *Purshia tridentata* |
| Herbaceous | *Achnatherum nelsonii* ssp. *dorei* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This low, moderately dense (40–60% cover of shrubs) shrubland is codominated by *Purshia tridentata* (18% cover) and *Artemisia tridentata* (23% cover), which form an open to intermittent canopy between 0.5–1 meter in height. *Symphoricarpos rotundifolius* also contributes a trace of cover to the shrub canopy. The herbaceous layer is fairly sparse and dominated by graminoids. *Achnatherum nevadense* and *Elymus elymoides* each provide 2.5 percent cover. *Bromus carinatus, Bromus tectorum* (exotic), and/or *Leymus triticoides* may each provide up to about 0.5 percent cover. Forbs commonly found in this association in trace amounts include *Eriogonum spergulinum, Phacelia humilis, Phacelia ramosissima, Phlox stansburyi, Crepis acuminata, Cryptantha echinella, Mentzelia albicaulis, Navarretia breweri, Stephanomeria spinosa,* and/or *Viola purpurea.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

*Achnatherum nevadense* is a polyploid derivative of *Achnatherum nelsonii* and *Achnatherum lettermanii*. More plots of this type need to be collected to confirm it as an association. This type is clearly related to *Purshia tridentata - Artemisia tridentata - Symphoricarpos rotundifolius* shrubland but appears to be slightly more xeric (see next description).

**Plots used to describe association (n=3)**

USGS–NPS Veg Data: 99K71, 99K72, 99K73

***Purshia tridentata - Artemisia tridentata - Symphoricarpos rotundifolius* Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Antelope Bitterbrush – Big Sagebrush – Roundleaf Snowberry Shrubland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Evergreen shrubland |
| PHYSIOGNOMIC GROUP | Microphyllous evergreen shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Microphyllous evergreen shrubland |
| ALLIANCE | *Purshia tridentata* Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is known from three locations in the Lundy Canyon and Mill Creek watersheds within the environs east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this vegetation are found between 7,200–10,000 feet of elevation on moderate to steep slopes. Aspects are variable, and stands prefer low and midslopes. Soils are sandy or silt loams derived from igneous or metamorphic rock.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Artemisia tridentata*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Artemisia tridentata, Purshia tridentata, Symphoricarpos rotundifolius*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This vegetation is characterized by an open to intermittent shrub canopy between 1–5 meters in height dominated by *Artemisia tridentata* (37% cover). *Purshia tridentata* (8.7% cover), *Symphoricarpos rotundifolius* (0.5% cover), and *Cercocarpus ledifolius* (0.5% cover) complete the shrub canopy. Emergent individuals of *Pinus jeffreyi* may be present. The herbaceous layer is rather sparse and dominated by forbs. *Wyethia mollis, Castilleja applegatei, Calochortus superbus, Lupinus argenteus, Descurainia californica,* and/or *Castilleja pilosa* each provide a scant amount of cover. The most common graminoid species are *Bromus carinatus* and *Achnatherum nevadense*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This type and *Purshia tridentata/Achnatherum nevadense* - *(Achnatherum nelsonii* ssp. *dorei*) shrubland are clearly related and may be lumped with further field data collection and analysis.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98K42, 98K79, 99K80, 99S58, 99S59

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***Salix exigua/Juncus* spp. Shrubland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Coyote Willow / Rush Species Shrubland** |
| **SYNONYM** | **Narrow-Leaf Willow Series (in part)** |
| PHYSIOGNOMIC CLASS | Shrubland |
| PHYSIOGNOMIC SUBCLASS | Deciduous shrubland |
| PHYSIOGNOMIC GROUP | Cold deciduous shrubland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Temporarily flooded cold deciduous shrubland |
| ALLIANCE | *Salix (exigua, interior)* Temporarily Flooded Shrubland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Palustrine |

RANGE
**Globally**
This association is known from the Great Plains, Stony Mountains, and the intermountain semidesert west.

**Yosemite and environs**
Stands of this association are known from the vicinity of lower Lee Vining Canyon.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association generally occurs along backwater channels and other perennially wet but less scoured sites such as floodplain swales and irrigation ditches. In Nebraska, this community is found on sandbars, islands, and shorelines of stream channels and braided rivers.

**Yosemite and environs**

Stands have been found on the wet edges of meadows and along narrow basins that have high water-holding capacity.

MOST ABUNDANT SPECIES

**Globally**

Shrub *Salix exigua*

**Yosemite and environs**

Shrub *Salix exigua*

CHARACTERISTIC SPECIES

**Globally**

Shrub *Salix exigua*

**Yosemite and environs**

Shrub *Salix exigua*

VEGETATION DESCRIPTION

**Globally**

This vegetation is quite variable and is dominated by perennial shrubs and grasses about 1 meter tall. *Salix exigua* is the common shrub. Others include saplings of *Populus deltoides* or *Salix amygdaloides, Salix eriocephala, Salix lutea,* and *Amorpha fruticosa*. Tall perennial grasses can appear to codominate the stand. Herbaceous species include *Bidens* spp., *Eleocharis* spp., *Juncus* spp., *Lobelia siphilitica, Lycopus americanus, Lythrum alatum, Polygonum* spp., *Schoenoplectus pungens (= Scirpus pungens), Sphenopholis obtusata*, and *Xanthium strumarium*. Diagnostic features of this association include the nearly pure stands of *Salix exigua* shrubs, with a dense ground layer of at least 30 percent cover of graminoids and forbs.

**Yosemite and environs**

Stands in the vicinity of Yosemite form a canopy of *Salix exigua* (63% cover) between 2–5 meters in height. Up to 20 percent cover of emergent *Salix exigua* may be present, to 10 meters in height. The ground layer is densely covered with graminoids and forbs, primarily *Juncus* and *Carex* species. Forb species may include *Achillea millefolium, Arnica longifolia, Castilleja miniata, Iris missouriensis,* and/or *Solidago spectabilis.* Graminoids commonly present include *Carex aquatilis* var. *aquatilis* (7.5% cover), *Carex lanuginosa* (7.5% cover), *Carex lenticularis* (7.5% cover), *Festuca idahoensis* (7.5% cover), *Juncus nevadensis* (7.5% cover), *Juncus macrandrus* (1.25% cover), *Agrostis gigantea* (exotic, 7.5% cover), *Hordeum brachyantherum*, and/or *Phleum alpinum* (1.25% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5?

RANK JUSTIFICATION

DATABASE CODE CEGL001203?

COMMENTS

**Globally**

**Yosemite and environs**
These stands appear to match descriptions for *Salix exigua*/Mesic Graminoids shrubland (CEGL001203) from the USNVC. This vegetation type needs more samples to confirm it as an association and to refine relationships with other types in the USNVC.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 98K40, 98K49

FORESTS AND WOODLANDS OF ECOLOGICAL ZONES VII AND VIII

***Populus tremuloides/Artemisia tridentata* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/Big Sagebrush Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is known from the montane areas of the western United States including Wyoming, California, Utah, Nevada, and Idaho.

**Yosemite and environs**
Stands of this association are found throughout the montane regions of the park.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is found on seasonally saturated soils on lower to middle slopes. Elevations range from 5,900–10,000 feet.

**Yosemite and environs**
This association is found on seasonally saturated soils on lower to middle slopes. Elevations range from 6,600–9,200 feet. Aspects are generally north and east. Soils are shallow loams derived from igneous rock.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |

VEGETATION DESCRIPTION
**Globally**
This association is characterized by *Populus tremuloides* as the dominant species in the tall-shrub or tree canopy. *Artemisia tridentata* is the dominant shrub or an important shrub. More information is not available at this time.

**Yosemite and environs**
This association is characterized by *Populus tremuloides* as the dominant species in the tall-shrub or tree canopy, with an average cover of 30 percent. The canopy varies from 10–30 meters in height. Occasional emergent conifers like *Pinus monticola* and/or *Pinus jeffreyi* may be present. *Artemisia tridentata* is the dominant shrub with an average cover of 4.5 percent. Other shrubs may include *Symphoricarpos rotundifolius* (2.5% cover) and *Rosa woodsii* (0.5% cover). *Gayophytum diffusum* is the most common forb, though it is present in only half of the stands and at less than 1 percent cover. Several graminoid species may be present at low cover values including *Elymus elymoides, Bromus carinatus,* and/or *Bromus tectorum* (exotic).

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3G4 |
| RANK JUSTIFICATION | This association is fairly widespread but not very common. There is concern about its long-term viability. |
| DATABASE CODE | CEGL000572 |

COMMENTS
**Globally**

**Yosemite and environs**
Note: This is a "generic" association that lacks several diagnostic species of other quaking aspen-sagebrush associations. With further sampling and comparison with other Great Basin quaking aspen stands, some revision of these associations may be in order. See comments on other quaking aspen associations below.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99S78, 99S83, 99S96, 98K48, 99K81

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***Populus tremuloides/Monardella odoratissima* Forest**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/Mountain Monardella Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is known from the Sierra Nevada ranging throughout the southern and eastern portions of the range. It is particularly common on the east side north of Bridgeport (Potter, 1998).

**Yosemite and environs**
This association is scattered throughout the montane regions of the park on either side of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is typically located on middle and lower slopes. Slopes are gentle (< 25% slope), often on southwest or southeast exposures. Stands usually have low rock cover; moderately high to high solar radiation; deep, essentially well drained soils of loam to clay texture; and soils derived from volcanic, granitic, and mixed parent materials. Elevations range from 6,920–9,100 ft. (Potter 1998).

**Yosemite and environs**
Stands of this association are found between 6,900–9,200 feet of elevation on southeastern to northwestern exposures. Slopes are gentle to moderate, and soils are fairly deep, well drained loams.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Populus tremuloides* (Potter 1998) |
| Shrub | *Populus tremuloides* |
| Herbaceous | *Collinsia torreyi* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Populus tremuloides* |
| Herbaceous | *Collinsia torreyi* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Populus tremuloides* (Potter 1998) |
| Shrub | None |
| Herbaceous | *Monardella odoratissima* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Monardella odoratissima* |

VEGETATION DESCRIPTION
**Globally**
This association is usually a mixed hardwood type with both *Populus tremuloides* and various conifers, such as *Abies magnifica* and *Pinus contorta*, comprising the canopy averaging between 33 and 85 percent (Potter 1998). Total vegetation cover is high (70–100%) from resulting high cover of the tree shrub and herbaceous layers. Shrubs include *Symphoricarpos mollis, Artemisia tridentata*, and *Symphoricarpos rotundifolius*. Forbs and grasses are common and include *Monardella odoratissima, Elymus glaucus*, Elymus *elymoides, Wyethia mollis, Thalictrum fendleri,Osmorhiza berteroi, Bromus marginatus, Hackelia micrantha*, and *Poa bolanderi.*

**Yosemite and environs**
This association is dominated by *Populus tremuloides* in the canopy as a tall shrub or tree averaging 40 percent cover. At least one of several conifer species is present. Potter (1994) describes two phases, mesic and dry. Conifer species may include *Abies magnifica* (21% cover), *Pinus jeffreyi* (16% cover), and/or *Juniperus occidentalis* (9% cover), depending on soil moisture. Common shrub associates include *Prunus emarginata* (4% cover) and *Artemisia tridentata* (4% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3

| | |
|---|---|
| RANK JUSTIFICATION | Many quaking aspen stands in California are threatened by grazing and by improper fire regime allowing invasion and overtaking of stands by conifers. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
All of the eastside quaking aspen associations defined herein are probably closely related ecologically. Potter's (1994) description of this type includes some eastside stands that we might call other types such as *Populus tremuloides/Artemisia tridentata* forest and *Populus tremuloides/Artemisia tridentata/Monardella odoratissima - Kelloggia galioides* forest. The exact relationships of these types remain to be seen. We have chosen to distinguish the nuances here because we feel that throughout the intermountain west there are a number of quaking aspen associations that mix with *Artemisia tridentata* and the subregional variants should be distinguished. With further samples and analysis throughout this region, we would see a clearer picture of the ecological relationships between these types.

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99S144 98K50
Potter (1998): has 19 plots sampled throughout the Sierra Nevada

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***Populus tremuloides/Artemisia tridentata/Monardella odoratissima - Kelloggia galioides* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/Big Sagebrush/Mountain Monardella - Milky Kelloggia Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is found in scattered locations throughout the eastside portions of the of the park. Occasional stands may occur in west side locations.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found between 6,900–8,900 feet of elevation on northern and eastern aspects. Stands are found on lower to middle, moderate to steep slopes. Soils are moderate to well drained sandy loams derived from granitic or metamorphic rock. Stands are primarily found east of the Sierra Nevada crest.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Monardella odoratissima, Elymus elymoides* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Monardella odoratissima, Kelloggia galioides* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is dominated by *Populus tremuloides* as a tall shrub or tree. The canopy averages about 18 percent cover, and varies between 5–10 meters in height. Emergent individuals of *Pinus contorta* are often present. *Artemisia tridentata* is the dominant shrub with an average cover of 13 percent. Other common shrub associates include *Salix scouleriana* (9.5% cover), *Prunus emarginata* (3.8% cover), *Symphoricarpos rotundifolius* (0.875% cover), *Ceanothus velutinus* (0.75% cover), and/or *Purshia tridentata* (0.75% cover). *Monardella odoratissima* (3.87% cover) and/or *Kelloggia galioides* (0.25% cover) each occur in the herbaceous layer with a 0.5 frequency. *Wyethia mollis* (0.25% cover) is also sometimes present. The graminoids *Elymus elymoides* (4.6% cover) and *Bromus carinatus* (0.5% cover) are present in every stand.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=6)**
USGS–NPS Veg Data: 99K98, 99K77, 99S122, 99K97, 99S61
Wieslander: **511**

***Populus tremuloides - Pinus jeffreyi* Forest**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen - Jeffrey Pine Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association is found mostly east of the park in the Buckeye Creek, Lee Vining Creek, Twin Lakes, June Lake, and other drainages flowing to the Great Basin.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is found on seasonally saturated soils on gentle to moderate lower slopes within or adjacent to narrow stream floodplains. Stands can occur on all aspects. This association seems to be confined to a fairly narrow elevation band, between 7,000–8,000 feet. Soils are usually well drained loams and loamy sands.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Rosa woodsii* |
| Herbaceous | *Allium campanulatum, Leymus cinereus* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides, Pinus jeffreyi* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This forest forms a canopy between 10–35 meters. *Pinus jeffreyi* dominates with 45 percent cover, and *Populus tremuloides* contributes 28 percent cover. Emergent individuals of *Pinus jeffreyi* are common. The shrub canopy is fairly sparse. *Artemisia tridentata* (1.5% cover) is present in nearly all stands. *Rosa woodsii* (10% cover), *Symphoricarpos rotundifolius* (4.5% cover), and *Cercocarpus ledifolius* (0.25% cover) are usually present. The herbaceous layer is sparse but diverse. The most common forbs include *Allium campanulatum* (0.88% cover), *Descurainia californica* (0.38% cover), *Osmorhiza berteroi* (0.25% cover), and/or *Phacelia ramosissima* (0.25% cover). Several graminoid species may be present including *Leymus cinereus* (4% cover), *Bromus laevipes* (1.3% cover), *Bromus tectorum* (exotic with 1.3% cover), *Poa pratensis* (0.88% cover), *Elymus elymoides* (4.38% cover), and/or *Elymus glaucus*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

This association, though related to other quaking aspen types in the east side of the area, appears distinct in the TWINSPAN classification. The stands usually signify narrow riparian stringers adjacent to slopes with coniferous forest (often *Pinus jeffreyi*-dominated).

**Plots used to describe association new (n=7)**

USGS–NPS Veg Data: 98M58, 98M46, 98K56, 98M56, 99S86
Wieslander: **92, 198**

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***Populus tremuloides/Poa pratensis* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/Kentucky Bluegrass Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |
| RANGE | |

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. Stands having these features have been described by Weixelman et al. (1999) in the Carson and Walker river drainages of California and Nevada.

**Yosemite and environs**
This association is only known from one stand in Lundy Canyon. It is expected in eastside meadows and riparian settings.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is found at 8,340 feet on the lower portion of a moderate slope. The aspect is southerly, and the soil is a poorly drained sandy loam derived from granite.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Populus tremuloides* |
| Herbaceous | *Poa pratensis* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Populus tremuloides* |
| Herbaceous | *Poa pratensis* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association forms a tree and/or tall-shrub canopy dominated by *Populus tremuloides* with up to 63 percent cover. Other shrubs present may include *Juniperus osteosperma* (0.5 % cover), *Ribes viscosissimum* (0.5% cover), *Symphoricarpos rotundifolius* (0.5% cover), and/or *Artemisia tridentata* (0.5% cover). The ground layer is dominated by graminoids, specifically *Poa pratensis* with 37.5 percent cover. Other graminoids present may include *Elymus elymoides* (2.5% cover) and/or *Leymus triticoides* (2.5% cover). The herbaceous layer is sparse. *Allium bisceptrum* may be present.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G1?

RANK JUSTIFICATION Only one stand of this association has ever been found.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Further plots are needed to substantiate this type. However, reconnaissance on the east side suggests that it is common in quaking aspen stands, subjected to grazing over time.

**Plots used to describe association (n=1)**
USGS–NPS Veg Data: 99S60

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***Populus tremuloides/Rosa woodsii* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen/Woods' Rose Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Deciduous forest |
| PHYSIOGNOMIC GROUP | Cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Montane or boreal cold deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 1 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is found at scattered locations throughout the eastern regions of the park and environs, primarily within the Great Basin scrub zone.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this forest are found between 6,700–7,600 feet of elevation. Aspects are east, and stands prefer gentle to moderate lower slopes, streamsides, and basins, which are seasonally saturated or flooded. Soils vary from loamy sands to clay.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Rosa woodsii* |
| Herbaceous | *Maianthemum stellatum, Poa pratensis* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides* |
| Shrub | *Rosa woodsii* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association forms an open to closed canopy of *Populus tremuloides* between 5–30 meters in height. *Rosa woodsii* provides the most cover in the shrub layer (5% cover), though *Artemisia tridentata* (0.67% cover) has the highest frequency. *Salix exigua* is also common in the shrub layer (5% cover). The herbaceous layer is quite diverse and can be rather dense. *Maianthemum stellatum* (3.5% cover) is the most frequent forb. Other common herbaceous associates may include *Equisetum arvense* (0.67% cover), *Achillea millefolium* (0.33% cover), *Aquilegia formosa* (0.57% cover), and/or *Iris missouriensis* (0.25% cover). Many graminoids can be present in this vegetation type, often achieving more than 25 percent cover. The most common graminoid species include *Poa pratensis* (exotic, 14.17% cover), *Leymus cinereus* (0.92% cover), *Leymus triticoides* (0.92% cover), and/or *Carex pellita* (0.58% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

A similar forest type is documented from Wyoming: *Populus tremuloides/Spiraea betulifolia* forest (CEGL000601).

**Yosemite and environs**

*Rosa woodsii* is not considered to be a good indicator of high-quality riparian sites (Weixelman et al. 1999). It is probably proper to infer that such stands are the result of impacts of livestock grazing and perhaps other riparian impacts.

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 98K46, 99K54, 99K86, 99K93, 99S57, 99S64

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***Populus balsamifera* ssp. *trichocarpa - Pinus jeffreyi* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Black Cottonwood - Jeffrey Pine Forest** |
| **SYNONYM** | **None** |

| | |
|---|---|
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed needle-leaved evergreen - cold deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed needle-leaved evergreen - cold deciduous forest |
| ALLIANCE | *Populus balsamifera* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

This association is found in the eastern region of the park and environs including Lee Vining Creek and Mill Creek.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This forest type grows between 6,900–7,780 feet elevation on gentle to moderate slopes with southerly to southeasterly exposures. Stands are found in valley bottoms along streams or occasionally midslopes with soils that are seasonally or permanently flooded. Soils are sands to silty loams derived from igneous rock and may be moderately well drained to well drained.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides, Populus balsamifera* ssp. *trichocarpa* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Poa pratensis* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus balsamifera* ssp. *trichocarpa, Pinus jeffreyi* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This forest is characterized by a broken tall canopy of *Pinus jeffreyi* 15–35 meters tall. In well developed stands *P. jeffreyi* forms an emergent or open overstory over a subcanopy of *Populus balsamifera*. Both species average about 34 percent cover each. Trees and saplings of *Populus tremuloides* and *Abies concolor* are also present. Individuals of *Juniperus occidentalis* may also be present in low cover. Occasionally *Pinus jeffreyi* may also be present as smaller trees or saplings. The shrub layer is dominated by *Rosa woodsii* (10% cover) with *Artemisia tridentata* and/or *Symphoricarpos rotundifolius* both averaging about 6 percent cover. The ground layer is dominated by graminoids. The herbaceous layer is sparse but relatively diverse. Most stands contain low cover of *Poa pratensis* and *Elymus elymoides*. *Wyethia mollis, Allium bisceptrum, Calochortus superbus, Iris missouriensis,* and/or *Maianthemum stellatum* occur infrequently.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Similar stands may range northward to the Modoc Plateau on the east side of the Warner Mountains, but these are uncommon and of limited extent.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
These are riparian stands that occur at the edges of *Pinus jeffreyi - Abies concolor/Artemisia tridentata - Symphoricarpos rotundifolius/Elymus elymoides* forest. *Populus balsamifera* seems to prefer relatively high-gradient creeksides within these forested zones on the east side of Yosemite. These are usually narrow stringer communities bordering on the adjacent forests of Jeffrey pine and white fir.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 98M55, 98M49, 98M50

---

***Populus tremuloides-Pinus contorta/Artemisia tridentata/Poa pratensis* Forest [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Mixed evergreen deciduous forest |
| PHYSIOGNOMIC GROUP | Mixed needle-leaved evergreen – cold-deciduous forest |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Mixed needle-leaved evergreen – cold-deciduous forest |
| ALLIANCE | *Populus tremuloides* Forest Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory. A similar association, *Pinus contorta* var. *murrayana - Populus tremuloides/Spiraea*

*douglasii* forest, has been defined for the northeastern Sierra, Modoc Plateau, and Blue Mountains of Oregon (NatureServe 2001).

**Yosemite and environs**
This association is found in the eastern portion of the mapping area on the east slope of the range, including Lee Vining Creek, Parker Creek, Walker Creek, Lundy Canyon, Virginia Creek Canyon, and Bloody Canyon,

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This forest type grows between 7,000–9,000 feet of elevation on northeast, east and southeast aspects. Stands are found in flood plains of valley bottoms or along streams with soils that are seasonally or permanently flooded. Soils are rapidly to somewhat poorly drained sands to silty loams derived from granite. Stands are not typically rocky. Substrates may have 0 – 40 % bare soil exposure and high leaf litter cover ranging from 20 – 98 %.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides, Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Poa pratensis* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Populus tremuloides, Pinus contorta* var. *murrayana* |
| Shrub | *Artemisia tridentata* |
| Herbaceous | *Poa pratensis* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This forest is characterized by a fairly continuous to fairly open canopy of *Populus tremuloides* 25% cover) and *Pinus contorta* (19% cover) between 15–30 meters of height. Individuals of *Pinus contorta* are sometimes emergent to 35 meters. Often *Pinus jeffreyi* is present as trees or saplings. The shrub layer is open with *Artemisia tridentata* (4% cover). Other important shrubs may include *Rosa woodsii* (4.6% cover) and/or *Symphoricarpos rotundifolius* (1.8% cover). The ground layer is dominated by graminoids. Most stands contain about 10 percent cover of *Poa pratensis* and 6 percent cover of *Bromus carinatus.* Other graminoids that may be present at low cover values include *Elymus trachycaulus* (2.5%) *Bromus tectorum* (exotic), *Elymus elymoides,* and/or *Leymus cinereus.* The herbaceous layer is sparse but relatively diverse. *Achillea millefolium, Taraxacum officinale* (exotic), *Wyethia mollis, Allium bisceptrum, Calochortus superbus, Iris missouriensis,* and/or *Maianthemum stellatum* all occur at about 0.5 percent cover with 33 to 66 percent frequency.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
A similar association has been defined for the Columbia Plateau and northern Great Basin, that is, *Pinus contorta* var. *murrayana* - *Populus tremuloides/Spiraea douglasii* forest (CEGL000157).

**Yosemite and environs**
This is another ecological relative of the several eastside quaking aspen associations. Potter (1994) treats all of his stands with quaking aspen, Sierra lodgepole pine, and sagebrush in the *Populus tremuloides/Monardella odoratissima* association. We have broken out the various additional stands we've sampled into several related associations. It is also uncertain whether we should treat this association as a member of the quaking aspen alliance, the Sierra lodgepole pine alliance, or a mixed quaking aspen Sierra lodgepole pine alliance. The preliminary classification unit, *Pinus contorta* - *Populus tremuloides* - *Pinus jeffreyi*, is now included in this association. Stands dominated by Populus tremuloides and Pinus contorta have been observed in the subalpine zone on the west slope, but insufficient samples are available to place those stands in this association.

**Plots used to describe association (n=5)**
USGS–NPS Veg Data: 99S65, 99K57, 99K84, 99K85, 98M52

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***Juniperus occidentalis* var. *australis* - *Cercocarpus ledifolius/Artemisia tridentata* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Sierra Juniper - Curl-leaf Mountain Mahogany/Big Sagebrush Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Juniperus occidentalis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is found throughout the Great Basin scrub region of the environs.

ENVIRONMENTAL DESCRIPTION

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is found between 7,500–8,400 feet of elevation. Stands grow on all aspects on moderate to steep midslopes. Soils are silty loams to loamy sands derived from granitic and metamorphic parent materials.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Cercocarpus ledifolius* |
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the eastern side of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* var. *australis* |
| Shrub | *Cercocarpus ledifolius, Artemisia tridentata* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the eastern side of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association forms an open to intermittent tree canopy between 10–20 meters of height. *Juniperus occidentalis* var. *australis* dominates the canopy with 12 percent cover, while *Pinus monophylla* often contributes another 4 percent cover to the canopy or as emergent individuals. The shrub or short-tree layer is open with *Cercocarpus ledifolius* dominant with 20.6 percent cover. *Artemisia tridentata* is also important with 2 percent cover. Other shrubs present may include *Symphoricarpos rotundifolius* (1.4% cover), *Eriogonum umbellatum* (0.9% cover), *Leptodactylon pungens* (0.375% cover), *Purshia tridentata* (0.75% cover), *Holodiscus discolor* (0.25% cover), and/or *Ribes velutinum* (0.25% cover). The ground layer is open to sparse seldom achieving more than 20 percent cover, and graminoids dominate the stratum. Graminoid species that may be present include *Elymus elymoides* (1% cover), *Melica stricta* (0.375% cover), *Poa secunda* (0.75% cover), and/or *Achnatherum hymenoides* (0.25% cover). *Penstemon speciosus* (0.25% cover) is the only forb which attains any appreciable cover.

OTHER NOTEWORTHY SPECIES

| | |
|---|---|
| CONSERVATION RANK | G3? |
| RANK JUSTIFICATION | Likely to occur on the east side of the Sierra Nevada crest on slopes bordering the Great Basin as far south as Kern County. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 99K96, 99S73, 99S93, 98M51

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***Juniperus occidentalis* var. *australis/Artemisia tridentata* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Sierra Juniper/Big Sagebrush Woodland** |
| **SYNONYM** | **Western Juniper/Sagebrush Association (Potter 1998)** |
| PHYSIOGNOMIC CLASS | Forest |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Juniperus occidentalis* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is known from the Sierra Nevada, ranging from the Lake Tahoe area south to at least Kaiser Pass (southern Sierra). It is primarily an eastside association but is known from the west side from Sonora Pass south (Potter 1998).

**Yosemite and environs**
This association is found in scattered locations in the eastern subalpine portions of the environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is a xeric middle to high elevation type. Stands generally range between 7,500–8,500 feet and occur on southeast and southwest aspects (Potter 1998). Slopes are commonly less than 30 percent. It is typically found on upper slopes and ridges. Stress indexes are higher than most other vegetation in the montane zone.

**Yosemite and environs**
This association is found from 7,800–9,300 feet of elevation on southern and eastern aspects. Stands grow on gentle to steep, lower to middle slopes. Soils are well drained sands to silt loams derived from granite.

MOST ABUNDANT SPECIES
**Globally**

| | |
|---|---|
| Tree | *Juniperus occidentalis*, *Pinus jeffreyi* (Potter 1998) |
| Shrub | *Artemisia tridentate* (Potter 1998) |
| Herbaceous | *Collinsia torreyi* var. *wrightii* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* |
| Shrub | *Artemisia tridentata* |

CHARACTERISTIC SPECIES
**Globally**

| | |
|---|---|
| Tree | *Juniperus occidentalis* (Potter 1998) |

| | |
|---|---|
| Shrub | *Artemisia tridentata* (Potter 1998) |
| Herbaceous | *Monardella odoratissima* (Potter 1998) |

**Yosemite and environs**

| | |
|---|---|
| Tree | *Juniperus occidentalis* |
| Shrub | *Artemisia tridentata* |

VEGETATION DESCRIPTION

**Globally**

This association forms open woodlands with a shrubby understory of *Artemisia tridentata.* Total vegetative cover is high due to abundant understory species. The principal tree species are *Juniperus occidentalis* (16% cover), *Pinus jeffreyi* (10%), *Pinus contorta* (16%); shrubs are *Artemisia tridentata* (16%), *Ribes cereum* (4%), *Symphoricarpos parishii* (4%), and *Ceanothus cordulatus* (8%). Herbs include *Monardella odoratissima* (4%), *Erysimum capitatum* var. *perenne (= Erysimum perenne)* (1%), *Gayophytum eriospermum* (6%), and *Castilleja applegatei* (2%)(Potter 1998).

**Yosemite and environs**

This association is characterized by an open tree canopy between 5–20 meters in height. *Juniperus occidentalis* dominates the canopy with 30 percent cover. *Pinus contorta* and/or *Pinus jeffreyi* are occasional associates contributing up to 10 percent cover. The shrub layer is open to intermittent with *Artemisia tridentata* (15% cover) as the dominant shrub. Other shrubs commonly present are *Purshia tridentata* (6% cover) and *Symphoricarpos rotundifolius* (10% cover). The ground layer is sparse and dominated by graminoids. Typical species include *Achnatherum hymenoides* (1% cover), *Bromus tectorum* (exotic with 1% cover), *Elymus elymoides* (1% cover), and *Leymus cinereus* (1% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION Increased fire frequency has a negative effect on this association.

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

This is similar to *Juniperus occidentalis/Artemisia tridentata* ssp. *vaseyana* woodland (CEGL000723). This is a low-productivity, largely eastside type similar and related to the *Juniperus occidentalis* association, more common on the west side.

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 99S146, 99K90, 99S147
Wieslander: **165, 289, 480**

***Pinus jeffreyi - Pinus monophylla* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine - Singleleaf Pinyon Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association is uncommon in Yosemite and environs and occurs on the eastside slopes.

ENVIRONMENTAL DESCRIPTION

**Globally**

Information about the global characteristics of the association is not available without additional inventory.

**Yosemite and environs**

**In Yosemite and environs, elevations range from 7,000–7,700 feet, and aspects are eastern. This association is found in low to middle slope positions, primarily near intermittent creeks. Soils are well drained loamy sands derived primarily from volcanic, granitic, or metamorphic parent materials. Bare soil ranges from 20–75 percent. Sites are upland or riparian.**

MOST ABUNDANT SPECIES

**Globally**

This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Pinus monophylla* |
| Shrub | *Artemisia tridentata* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Pinus monophylla* |

VEGETATION DESCRIPTION
**Globally**
This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, this association is characterized by tree cover of up to 60 percent in the 35–50 meter height class, although most stands have a lower canopy cover and height. It is dominated by *Pinus jeffreyi* and *Pinus monophylla*. *Pinus jeffreyi* averages 31 percent cover, while *Pinus monophylla* averages 38 percent cover. The shrub layer ranges between 15–25 percent and is dominated by *Artemisia tridentata*, with an average 10 percent cover. *Purshia tridentata* is also present in lower amounts. The herb layer averages 5 percent cover, with *Bromus tectorum* (exotic) and *Elymus elymoides* being the most frequent species.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99K94, 99S100, 99K58

---

***Pinus jeffreyi/Purshia tridentata* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine/Antelope Bitterbrush Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only described from Yosemite and environs and from the Indiana Summit Research Natural Area about eight miles southeast of the study area (Taylor, 1980).

**Yosemite and environs**
This association is occasional on the eastern slopes of the Sierra Nevada in Mono Basin including Horse Meadows, Log Cabin Mine Road, Parker Creek–June Lake area, and Lundy Canyon–Mill Creek area.

ENVIRONMENTAL DESCRIPTION
**Globally**
Taylor (1980) reports this association from the volcanic ash flows and welded volcanic tufa south of the Mono Craters. Soils are orthic humic Entisols. Most precipitation falls as snow, which reaches 1 meter deep and may persist on the ground for three months. Precipitation is estimated at being 12–16 inches per year. Several similar associations exist on the Modoc Plateau (Smith 1994).

**Yosemite and environs**
**In Yosemite and environs, elevations range from 7,200–8,100 feet, and aspects are variable. This association is found in low to high slope positions, but all sites are considered uplands. Soils are rapidly drained to well drained sands and sandy loams derived primarily from igneous rock. Litter/Duff cover ranges from 5–95 percent.**

MOST ABUNDANT SPECIES
**Globally**
This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Purshia tridentata, Artemisia tridentata* |
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Artemisia tridentata, Purshia tridentata* |

VEGETATION DESCRIPTION
**Globally**
This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
*Pinus jeffreyi*, with 44 percent average cover, was the sole mature tree in sampled stands. The canopy is from 20–35 meters in height. *Pinus jeffreyi* saplings occur infrequently in the shrub layer. Shrub cover ranges from 10–20 percent with *Artemisia tridentata* averaging 8 percent and *Purshia tridentata* 5 percent cover. The herbaceous layer is sparse, varying from less than 1 to 10 percent cover. *Elymus elymoides* is the only frequent species in the herb layer and averages 4 percent cover. Other herb species include *Wyethia mollis, Cryptantha echinella, Eriogonum spergulinum, Leptodactylon pungens,* and the non-native *Bromus tectorum*. Total vegetation cover is 50–70 percent. Total species number about 50 in the four plots sampled locally.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

| | |
|---|---|
| RANK JUSTIFICATION | Depending on the definition this may be a common type on the east side of the Sierra Nevada from Modoc Plateau to the area around Walker Pass. However, many stands have been logged or grazed heavily in the past. |
| DATABASE CODE | To be determined |

COMMENTS
**Globally**

**Yosemite and environs**
The regular presence of *Artemisia tridentata* in these local stands suggests that they may be somewhat different than the associations defined by Taylor (1980) or Smith (1994), where *Purshia tridentata* appears to be the sole dominant understory shrub.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98M59, 98K47, 98M38, 99S56

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***Pinus jeffreyi/Cercocarpus ledifolius* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association has only been described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is common in the eastern portion of Yosemite and environs.

ENVIRONMENTAL DESCRIPTION
**Globally**
Information about the global characteristics of the association is not available without additional inventory.

**Yosemite and environs**
**In Yosemite and environs, elevations range from 7,500–8,700 feet, and aspects are variable. This association is found in low to high slope positions. Soils are moderately well- to well drained loamy sands and sandy loams derived primarily from granite. Litter/Duff cover ranges from 5–95 percent. Sites are upland.**

MOST ABUNDANT SPECIES

**Globally**

This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Cercocarpus ledifolius, Artemisia tridentata* |
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi* |
| Shrub | *Cercocarpus ledifolius* |

VEGETATION DESCRIPTION

**Globally**

This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

*Pinus jeffreyi*, with 36 percent average cover, was the sole mature tree in sampled stands. Trees range from 10–50 meters in height. *Abies concolor* and *Pinus albicaulis* saplings occur infrequently in the shrub layer. Shrub cover averages 24 percent, with *Cercocarpus ledifolius* averaging 16 percent cover. *Artemisia tridentata*, another frequent shrub, averages 5 percent cover. The herbaceous layer varies from 5–50 percent cover, with a 13 percent average cover. *Elymus elymoides* is the only frequent species in the herb layer and averages 1.5 percent cover. Other herb species include *Linanthus pachyphyllus*, *Poa secunda*, and *Wyethia mollis*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS

**Globally**

**Yosemite and environs**

**Plots used to describe association (n=6)**

USGS–NPS Veg Data: 99K129, 99K76, 99K82, 99S80, 99S77, 99S85

***Pinus jeffreyi - Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Jeffrey Pine - White Fir/Roundleaf Snowberry/Bottlebrush Squirreltail Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus jeffreyi* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association has only been described from the east side of Yosemite and environs. Information about its global characteristics is not available without additional inventory. A very similar vegetation type (if not identical) was described by Taylor (1980) at Indiana Summit Research Natural Area about 10 miles southeast of the southeastern-most portion of the study area (Mono County). He called it the *Abies concolor/Prunus emarginata* association.

**Yosemite and environs**

This association is uncommon in Yosemite and environs, where it occurs on the east side of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

Information about the global characteristics of the association is not available without additional inventory.

**Yosemite and environs**

**In Yosemite and environs, elevations range from 7,800–8,600 feet, and aspects and slopes are variable. This association is found primarily in low slope positions; one plot was on the edge of a lake. Soil drainage is variable, and texture is either loamy sand or sandy loam. Soils are derived from granite. Litter/Duff cover ranges from 60 to 90 percent. Sites are upland.**

MOST ABUNDANT SPECIES

**Globally**

This association has only been described from Yosemite and environs to date. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies concolor* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus jeffreyi, Abies concolor* |
| Shrub | *Symphoricarpos rotundifolius, Artemisia tridentata* |

Herbaceous *Elymus elymoides*

VEGETATION DESCRIPTION
**Globally**
This association is only described from Yosemite and environs. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
In Yosemite and environs, *Pinus jeffreyi*, with 27 percent average cover, is the dominant canopy tree. *Abies concolor* is not always present in the tree layer, in which it has an average 17 percent cover, but sometimes only occurs in the shrub layer. Trees range from 5–50 meters in height. *Symphoricarpos rotundifolius* and *Artemisia tridentata* are the most frequent shrub species, both with an average cover of less than 2 percent. *Elymus elymoides* is the only constant species in the herb layer but averages 0.5 percent cover. Other herbaceous species include *Lupinus argenteus, Arabis bodiensis, Bromus carinatus, Poa wheeleri, Poa secunda*, and *Poa pratensis*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3?

RANK JUSTIFICATION The relatively mesic setting for this eastside association is probably uncommonly found, and where it occurs it is likely to have been logged or otherwise impacted by human disturbance.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
Note: This type was called *Pinus jeffreyi - Abies concolor/Poa fendleriana* in the preliminary classification.

**Plots used to describe association (n=3)**
USGS–NPS Veg Data: 99K75, 99S75, 99S95

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***Pinus monophylla/Cercocarpus ledifolius/Artemisia tridentata - Purshia tridentata* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Singleleaf Pinyon-Curl-leaf Mountain Mahogany/Big Sagebrush - Antelope Bitterbrush Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus monophylla (Juniperus occidentalis)* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |
| RANGE | |

**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found to the east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association grows on northeast to northwest aspects between 7,000–7,900 feet of elevation. Stands grow on moderate to steep lowslopes and midslopes. Soils are silty to loamy sands derived from igneous rocks. Aspects can be varied and do not seem to differentiate this type.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Pinus monophylla*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Tree *Pinus monophylla*
Shrub *Cercocarpus ledifolius, Artemisia tridentata, Purshia tridentata*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this vegetation form open canopies of *Pinus monophylla* between 5–10 meters in height, achieving approximately 25–35 percent cover. *Juniperus occidentalis* may co-occur at much lower cover values. *Cercocarpus ledifolius* occurs in scattered patches in the tree understory totaling only about 1.5 percent cover. The shrub layer is quite sparse with *Artemisia tridentata, Purshia tridentata,* and *Eriogonum umbellatum* each totaling about 1.5 percent cover. The herbaceous layer is very sparse with large patches of bare ground. The dominant life-forms in the ground layer are graminoids including *Achnatherum hymenoides, Achnatherum speciosum, Elymus elymoides,* and/or *Melica stricta* each attaining about 0.5 percent cover. The forb *Arabis platysperma* occurs regularly though it only achieves about 0.5 percent cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
*Pinus monophylla/Artemisia tridentata* woodland (CEGL000827) and *Pinus monophylla/Cercocarpus ledifolius* woodland (CEGL000828) from the USNVC may be similar to this association. More study is needed.

**Yosemite and environs**
This association was combined with *Pinus monophylla/Cercocarpus ledifolius/Artemisia tridentata/Arabis platysperma* woodland of the preliminary classification.

**Plots used to describe association (n=4)**
USGS–NPS Veg Data: 98K43, 99S68, 99S88, 99S89

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***Pinus monophylla/Ribes velutinum* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Singleleaf Pinyon/Desert Gooseberry Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus monophylla (Juniperus occidentalis)* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 2 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
This association is found in the montane regions east of the Sierra Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association is found between 7,000–7,800 feet of elevation on northwest to southeast exposures. Stands prefer moderate to steep slopes on lower to upper slope positions. Soils are sandy to silty loams.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.
**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monophylla* |
| Shrub | *Artemisia tridentata* |

| | |
|---|---|
| Herbaceous | *Elymus elymoides* |

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monophylla* |
| Shrub | *Ribes velutinum* |

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association has an open canopy of *Pinus monophylla* averaging 26 percent cover 5–10 meters in height. *Cercocarpus ledifolius* (4% cover) often forms a sparse subcanopy. The shrub layer is sparse with *Artemisia tridentata* (8.7% cover), *Purshia tridentata* (5.8% cover), and/or *Eriogonum umbellatum* (0.3% cover). *Ribes velutinum* (1 % cover) is the diagnostic shrub species. The herbaceous layer is dominated by graminoids such as *Elymus elymoides* (1.2% cover), *Bromus tectorum* (exotic, 0.6% cover), *Melica stricta* (0.6% cover), *Achnatherum hymenoides* (0.4% cover), and/or *Achnatherum speciosum* (0.5% cover).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**
This is closely related to the former *Pinus monophylla/Cercocarpus ledifolius/Artemisia tridentata – Purshia tridentata* description. However, the constancy of *Cercocarpus ledifolius* is not as high and the presence of *Ribes velutinum* is constant. With further analysis and more plots, there may be further adjustment to these association definitions.

**Plots used to describe association (n=9)**
USGS–NPS Veg Data: 98K44, 98M39, 98M45, 99K55, 99K56, 99K59, 99K61, 99K63, 99K87

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***Pinus monophylla/Artemisia tridentata/Elymus elymoides* Woodland [Provisional]**

| | |
|---|---|
| **COMMON NAME** | **Singleleaf Pinyon/Big Sagebrush/Bottlebrush Squirreltail Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Temperate or subpolar needle-leaved evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural/Seminatural |

| | |
|---|---|
| FORMATION | Rounded-crowned temperate or subpolar needle-leaved evergreen woodland |
| ALLIANCE | *Pinus monophylla (Juniperus occidentalis)* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**

Stands of this association are found in the montane regions to the east of the Sierra Nevada crest.

ENVIRONMENTAL DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

This association grows on south to southeast aspects between 7,500–7,600 feet of elevation. Stands grow on steep midslopes. Soils are loamy sands derived from metamorphic rocks.

MOST ABUNDANT SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monophylla* |
| Shrub | *Artemisia tridentata* |

CHARACTERISTIC SPECIES

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

| | |
|---|---|
| Tree | *Pinus monophylla* |
| Shrub | *Artemisia tridentata*, *Purshia tridentata* |
| Herbaceous | *Elymus elymoides* |

VEGETATION DESCRIPTION

**Globally**

This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**

Stands of this vegetation form open canopies of *Pinus monophylla* between 5–15 meters in height, achieving approximately 37.5 percent cover. The shrub layer is quite sparse with *Artemisia tridentata* dominating with 2.5 percent cover. Other common associates include *Purshia tridentata*, *Ericameria nauseosa* ssp. *nauseosa*, *Tetradymia canescens*, and *Galium multiflorum*, each totaling about 0.25 percent cover. The herbaceous layer is very sparse with large patches of bare ground. Graminoids dominate the ground layer and, aside from the constant

*Elymus elymoides*, may include *Achnatherum speciosum* and/or *Poa secunda*, each attaining about 0.5 percent cover.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK To be determined

RANK JUSTIFICATION

DATABASE CODE To be determined

COMMENTS
**Globally**
*Pinus monophylla/Artemisia tridentata* woodland (CEGL000827) from the USNVC may be similar to this association. More study is needed.

**Yosemite and environs**

**Plots used to describe association (n=2)**
USGS–NPS Veg Data: 99S91, 99S92

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***Cercocarpus ledifolius/Symphoricarpos rotundifolius* Woodland**

| | |
|---|---|
| **COMMON NAME** | **Curl-leaf Mountain Mahogany/Roundleaf Snowberry Woodland** |
| **SYNONYM** | **None** |
| PHYSIOGNOMIC CLASS | Woodland |
| PHYSIOGNOMIC SUBCLASS | Evergreen woodland |
| PHYSIOGNOMIC GROUP | Extremely xeromorphic evergreen woodland |
| PHYSIOGNOMIC SUBGROUP | Natural /Seminatural |
| FORMATION | Sclerophyllous extremely xeromorphic evergreen woodland |
| ALLIANCE | *Cercocarpus ledifolius* Woodland Alliance |
| CLASSIFICATION CONFIDENCE LEVEL | 3 |
| USFWS WETLAND SYSTEM | Upland |

RANGE
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global range is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found in scattered locations in the montane regions east of the Sierra Nevada Crest.

ENVIRONMENTAL DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Stands of this association are found between 7,600–9,300 feet of elevation on northwest to southwest aspects. Stands usually occur on midslopes though some occur on upper slopes and ridges. Slopes are moderate to steep, and soils are silty to sandy loams derived from igneous or metamorphic parent materials.

MOST ABUNDANT SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Cercocarpus ledifolius*

CHARACTERISTIC SPECIES
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
Shrub *Cercocarpus ledifolius, Symphoricarpos rotundifolius*

VEGETATION DESCRIPTION
**Globally**
This association is only known from the vicinity of Yosemite. Information about its global characteristics is not available without additional inventory.

**Yosemite and environs**
This association forms an intermittent canopy of *Cercocarpus ledifolius* (50% cover) between 2–5 meters in height. Occasional emergent individuals of *Juniperus occidentalis* (1.8% cover) may be present. *Artemisia tridentata* dominates the shrub layer with 4.5 percent cover. *Symphoricarpos rotundifolius* is the diagnostic shrub providing 1.3 percent cover in the shrub understory. *Eriogonum umbellatum* (0.13% cover), *Holodiscus discolor* (0.38% cover), *Chrysothamnus viscidiflorus* (0.13% cover), and *Leptodactylon pungens* (0.13% cover) may also be present. The herbaceous layer is quite sparse and dominated by graminoids. *Melica stricta* (0.4% cover), *Elymus elymoides* (0.8% cover), and/or *Achnatherum hymenoides* (0.19% cover) are usually present. A wide diversity of other graminoids and forbs may be present at very low cover values.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4?

RANK JUSTIFICATION May be relatively widespread up and down the east slope of the Sierra Nevada and also possibly in other parts of the Great Basin.

DATABASE CODE To be determined

COMMENTS
**Globally**

**Yosemite and environs**

**Plots used to describe association (n=8)**
USGS–NPS Veg Data: 99K65, 99K66, 99K69, 99K70, 99S90, 99S97, 99S99, 99S81

# Appendix L: New and Previously Defined Types Needing Additional Sampling

This appendix provides a list of associations either 1) newly defined from data associated with the Yosemite vegetation mapping effort and needing sampling for verification or 2) authored as indicated but needing additional sampling. Descriptions are available in Appendix K where the sample size for a type is at least three plots; however, these types are still preliminary and require further sampling for verification.

## Tree associations

### *Forests*

Canyon Live Oak-Gray Pine Forest
(*Quercus chrysolepis-Pinus sabiniana* Forest)

Canyon Live Oak-Ponderosa Pine Forest
(*Quercus chrysolepis-Pinus ponderosa* Forest)

Canyon Live Oak-Incense-cedar Forest
(*Quercus chrysolepis-Calocedrus decurrens* Forest)

Sierra Lodgepole Pine/Bog Blueberry Forest
(*Pinus contorta* var. *murrayana*/*Vaccinium uliginosum* Forest)

Sierra Lodgepole Pine/Shorthair Sedge Woodland
(*Pinus contorta* var. *murrayana/Carex exserta* Woodland)

Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest
(*Pinus contorta* ssp. *murrayana-Pinus albicaulis/Carex exserta* Forest) (n=2)

Ponderosa Pine-Incense-cedar/Mountain Misery Forest
(*Pinus ponderosa-Calocedrus decurrens/Chamaebatia foliolosa* Forest)

White Fir-Sugar Pine/Whitethorn Ceanothus Forest
(*Abies concolor-Pinus lambertiana/Ceanothus cordulatus* Forest)

California Red Fir-Western White Pine/Huckleberry Oak Forest
(*Abies magnifica-Pinus monticola/Quercus vaccinifolia* Forest) (n=0)

Douglas-Fir-White Fir-Incense-cedar Forest
(*Pseudotsuga menziesii-Abies concolor-Calocedrus decurrens* Forest)

Douglas-fir-White Alder Forest
(*Pseudotsuga menziesii-Alnus rhombifolia* Forest) (n=2)

Douglas-Fir-Ponderosa Pine-Incense-cedar Forest
(*Pseudotsuga menziesii-Pinus ponderosa-Calocedrus decurrens* Forest)

Quaking Aspen-Jeffrey Pine Forest
(*Populus tremuloides-Pinus jeffreyi* Forest)

Quaking Aspen/Kentucky Bluegrass Forest
(*Populus tremuloides/Poa pratensis* Forest [Provisional])

Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest
(*Populus tremuloides-Pinus contorta* ssp. *murrayana*/*Artemisia tridentata*/*Poa pratensis* Forest) (n=4)

Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest

(*Populus tremuloides-Pinus contorta* var. *murrayana*/*Artemisia tridentata*/*Poa pratensis* Forest)

Quaking Aspen/Big Sagebrush Forest
(*Populus tremuloides/Artemisia tridentata* Forest) (n=5)

Quaking Aspen/Big Sagebrush/Mountain Monardella-Milky Kelloggia Forest
(*Populus tremuloides/Artemisia tridentata/Monardella odoratissima-Kelloggia galioides* Forest) (close to Potter's 1998 *Populus tremuloides/Monardella odoratissima*) (n=6)

Quaking Aspen/Woods' Rose Forest
(*Populus tremuloides*/*Rosa woodsii* Forest) (n=6)

Quaking Aspen/ Kentucky Bluegrass Forest
(*Populus tremuloides/Poa pratensis* Forest) (similar to some Weixelman and Zamudio plots (1999) (n=1)

California Black Oak/Mewuk Manzanita-Mountain Misery Forest
(*Quercus kelloggii/Arctostaphylos mewukka-Chamaebatia foliolosa* Forest) (n=4)

California Black Oak-Incense-cedar Forest
(*Quercus kelloggii-Calocedrus decurrens* Forest) (n=9)

Black Cottonwood-Jeffrey Pine Forest
(*Populus balsamifera* ssp. *trichocarpa-Pinus jeffreyi* Forest) (n=3)

Black Cottonwood/(Western Azalea) Forest
(*Populus balsamifera* ssp. *trichocarpa/Rhododendron occidentalis* Forest) (n=2)

VELVET ASH FOREST ALLIANCE
(*FRAXINUS LATIFOLIA* FOREST ALLIANCE) (defined by Potter 2000 ms plots) (n=2)

***Woodlands***

Gray Pine/Buckbrush/Grass Woodland
(*Pinus sabiniana/Ceanothus cuneatus*/grass Woodland) (n=1)

Gray Pine-Interior Live Oak/Buckbrush Woodland
(*Pinus sabiniana-Quercus wislizeni/Ceanothus cuneatus* Woodland) (n=4)

Gray Pine-Interior Live Oak/Whiteleaf Manzanita Woodland
(*Pinus sabiniana-Quercus wislizeni*/*Arctostaphylos viscida* Woodland) (n=4)

Interior Live Oak-Canyon Live Oak Woodland
(*Quercus wislizeni-Quercus chrysolepis* Woodland) (n=3)

Interior Live Oak/Whiteleaf Manzanita Woodland
(*Quercus wislizeni/Arctostaphylos viscida* Woodland) (Allen et al., 1991) (n=2)

California Buckeye/Silver Lupine Woodland
(*Aesculus californica/Lupinus albifrons* Woodland) (n=1)

California Buckeye/Durango Root Woodland
(*Aesculus californica/Datisca glomerata* Woodland) (n=1)

Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland
(*Juniperus occidentalis* ssp. *australis-Cercocarpus ledifolius/Artemisia tridentata* Woodland) (n=4)

Whitebark Pine/Davidson's Penstemon Woodland
(*Pinus albicaulis/Penstemon davidsonii* Woodland) (Taylor 1984) (n=2)

Whitebark Pine/Ross Sedge Woodland
(*Pinus albicaulis/Carex rossii* Woodland) Includes the Whitebark pine/Wheeler bluegrass Woodland (*Pinus albicaulis/Poa wheeleri* Woodland) of Taylor (1984) (n=5)

Knobcone Pine/Whiteleaf Manzanita Woodland
(*Pinus attenuata/Arctostaphylos viscida* Woodland) (n=3)

Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland
(*Pinus jeffreyi-Cercocarpus ledifolius* Woodland)

Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland
(*Pinus jeffreyi-Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland) (n=3)

Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland
(*Pinus jeffreyi-Quercus chrysolepis/ Arctostaphylos viscida* Woodland)

Jeffrey Pine-Singleleaf Pinyon Pine Woodland
(*Pinus jeffreyi-Pinus monophylla* Woodland)

Jeffrey Pine/Whitethorn Ceanothus Woodland
(*Pinus jeffreyi/Ceanothus cordulatus* Woodland) (Potter 1998) (n=3)

Singleleaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big sagebrush-Antelope Bitterbrush Woodland
(*Pinus monophylla-Cercocarpus ledifolius/Artemisia tridentata-Purshia tridentata* Woodland) (n=4)

Singleleaf Pinyon Pine/Desert Gooseberry Woodland
(*Pinus monophylla /Ribes velutinium* Woodland) (n=9)

Singleleaf Pinyon Pine/Big sagebrush/Squirreltail Woodland
(*Pinus monophylla/Artemisia tridentata/Elymus elymoides* Woodland) (n=2)

Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland
(*Pinus ponderosa-Quercus kelloggii/ Arctostaphylos viscida* Woodland) (n=5)

Curl-leaf Mountain Mahogany/Roundleaf Snowberry Woodland
(*Cercocarpus ledifolius/Symphoricarpos rotundifolius* Woodland)

Blue Oak/Brome Species-American Wild Carrot Woodland
(*Quercus douglasii/Bromus* spp.-*Daucus pusillus* Woodland [Provisional])

RED WILLOW TEMPORARILY FLOODED WOODLAND ALLIANCE
(*SALIX LAEVIGATA* TEMPORARILY FLOODED WOODLAND ALLIANCE) (n=2)

### Shrubland associations

Silver Lupine Shrubland
(*Lupinus albifrons* Shrubland) (n=3)

Chamise-Whiteleaf Manzanita Shrubland
(*Adenostoma fasciculatum-Arctostaphylos viscida* Shrubland) (n=2)

Chamise Shrubland
(*Adenostoma fasciculatum* Shrubland) (n=5)

Chamise-Buckbrush Shrubland
(*Adenostoma fasciculatum-Ceanothus cuneatus* Shrubland) (n=5)

Buckbrush/Brome species Shrubland

(*Ceanothus cuneatus*/*Bromus* spp. Shrubland) (n=5)

Chaparral Whitethorn/Poison Oak Shrubland
(*Ceanothus leucodermis/Toxicodendron diversilobum* Shrubland) (n=2)

Mountain Misery-Whiteleaf Manzanita Dwarf-shrubland
(*Chamaebatia foliolosa- Arctostaphylos viscida* Dwarf-shrubland) (n=4)

Huckleberry Oak Shrubland
(*Quercus vaccinifolia* Shrubland) (n=2)

Huckleberry Oak-Bush Chinquapin Shrubland
(*Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland) (n=4)

Silver Sagebrush/Missouri Iris-Baltic Rush Shrubland
(*Artemisia cana/Iris missouriensis-Juncus balticus* Shrubland) (n=2)

Mountain Big Sagebrush/Shorthair Sedge Shrubland
(*Artemisia tridentata* ssp. *vaseyana/Carex exserta* Shrubland) (n=3)

Mountain Big Sagebrush/Mountain Monardella Shrubland
(*Artemisia tridentata* ssp. *vaseyana /Monardella odoratissima* Shrubland) (n=3)

Big Sagebrush-Rubber Rabbitbrush Shrubland
(*Artemisia tridentata-Ericameria nauseosa* Shrubland) (n=1)

Big Sagebrush/Indian Ricegrass Shrubland
(*Artemisia tridentata/Achnatherum hymenoides* Shrubland) (n=2)

Snowbrush Ceanothus-Bitter Cherry-Big Sagebrush Shrubland
(*Ceanothus velutinus-Prunus emarginata-Artemisia tridentata* Shrubland) (n=6)

Antelope Bitterbrush-Big Sagebrush-Spineless Horsebrush Shrubland
(*Purshia tridentata-Artemisia tridentata-Tetradymia canescens* Shrubland) (n=7)

Antelope Bitterbrush-Big Sagebrush/Indian Ricegrass Shrubland
(*Purshia tridentata-Artemisia tridentata/Achnatherum hymenoide*s Shrubland) (n=4)

Antelope Bitterbrush-Big Sagebrush/Nevada Needlegrass-(Dore's Needlegrass) Shrubland
(*Purshia tridentata-Artemisia tridentata/Achnatherum nevadense-(Achnatherum nelsonii* ssp. *dorei*) Shrubland) (n=3)

Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Shrubland
(*Purshia tridentata-Artemisia tridentata-Symphoricarpos rotundifolius* Shrubland) (n=5)

Birchleaf Mountain Mahogany Sierran Chaparral Shrubland
(*Cercocarpus montanus* var. *glaber* [*C. betuloides* var. *betuloides*, Hickman 1993] Sierran Chaparral Shrubland) (n=5)

Deerbrush-Whiteleaf Manzanita-(Indian Manzanita) Shrubland
(*Ceanothus integerrimus-Arctostaphylos viscida*-[*Arctostaphylos mewukka*] Shrubland) (n=2)

Deerbrush-Whitethorn Ceanothus Stands
(*Ceanothus integerrimus-Ceanothus cordulatus* Stands) (n=2)

Oceanspray-European Red Elderberry Shrubland
(*Holodiscus discolor-Sambucus racemosa* Shrubland) (n=1)

Oceanspray/Sierra Stonecrop-Parsley Fern Shrubland
(*Holodiscus discolor/Sedum obsusatum* ssp. *boreale-Cryptogramma acrostichoides* Shrubland) (n=4)

Bitter Cherry Shrubland
(*Prunus emarginata* Shrubland) (n=3)

Narrow-leaf Willow/Rush Shrubland
(*Salix exigua/Juncus* spp. Shrubland) (n=2)

Arroyo Willow-Canyon Live Oak/Spice Bush Shrubland
(*Salix lasiolepis-Quercus chrysolepis/Calycanthus occidentalis* Shrubland) (n=1)

Lemmon's Willow Shrubland
(*Salix lemmonii* Shrubland) (n=3)

Dusky Willow Shrubland
(*Salix melanopsis* Shrubland) (n=3)

Tea-leaf Willow Shrubland
(*Salix planifolia* Shrubland) (n=6)

Tea-leaf Willow-Rocky Mountain Sedge Shrubland
(*Salix planifolia/Carex scopulorum* Shrubland) (Taylor 1984) (n=1)

Low Sagebrush/Prickly Phlox Dwarf-shrubland
(*Artemisia arbuscula/Leptodactylon pungens* Dwarf-Shrubland) (n=4)

Low Sagebrush/Slender Buckwheat Dwarf-shrubland
(*Artemisia arbuscula/Eriogonum microthecum* Dwarf-Shrubland) (n=3)

Mountain Misery-Whiteleaf Manzanita Dwarf-shrubland
(*Chamaebatia foliolosa- Arctostaphylos viscida* Dwarf-shrubland [Provisional]) (n=4)

Sierra Bilberry/Shorthair Sedge Dwarf-shrubland
(*Vaccinium caespitosum/Carex exserta* Dwarf-shrubland) (n=4)

Bog Blueberry Dwarf-shrubland
(*Vaccinium uliginosum* Dwarf-shrubland) (n=3)

### Herbaceous associations

Blue Wild Rye Herbaceous Vegetation
(*Elymus glaucus* Herbaceous Vegetation) (n=1)

Blue Wild Rye-Wooly Sedge Herbaceous Vegetation
(*Elymus glaucus-Carex pellita* [*Carex lanuginosa*, Hickman 1993] Herbaceous Vegetation) (n=4)

Blue Wild Rye-Greensheath Sedge Herbaceous Vegetation
(*Elymus glaucus-Carex feta* Herbaceous Vegetation) (n=3)

Shorthair Reedgrass-Alpine Aster Herbaceous Vegetation
(*Calamagrostis breweri-Oreostemma* alpigenum var. *andersonii* [*Aster alpigenus* var. *andersonii*, Hickman 1993] Herbaceous Vegetation) (n=5)

Shorthair Reedgrass-Spike Trisetum Herbaceous Vegetation
(*Calamagrostis breweri-Trisetum spicatum* Herbaceous Vegetation) (n=4)

Shorthair Reedgrass-Drummond Rush Herbaceous Vegetation
(Calamagrostis breweri-Juncus drummondii Herbaceous Vegetation) (Taylor, 1984) (n=1)

Purple Reed Grass-Parry Rabbitbrush-Granite gilia Herbaceous Vegetation
(*Calamagrostis purpurascens-Chrysothamnus parryi* ssp. *monocephalus-Leptodactylon pungens* Herbaceous Vegetation) (Taylor, 1984) (n=1)

European Red Elderberry/Congdon's Sedge Herbaceous Vegetation
(*Sambucus racemosa*/*Carex congdonii* Herbaceous Vegetation) (Taylor, 1984) (n=1)

Shorthair Sedge-Spike Trisetum Herbaceous Vegetation
(*Carex exserta-Trisetum spicatum* Herbaceous Vegetation) (n=6)

HELLER SEDGE HERBACEOUS ALLIANCE
(*CAREX HELLERI* HERBACEOUS ALLIANCE) (Taylor 1984) (n=3)

Heller Sedge-Silvery Buckwheat-Silky Raillardella Herbaceous Vegetation
(*Carex helleri- Eriogonum incanum-Raillardella argentea* Herbaceous Vegetation) (Taylor 1984) (n=1)

Heller Sedge-Alpine Saxifrage-Woodrush Herbaceous Vegetation
(*Carex helleri-Saxifraga tolmiei-Luzula divaricata* Herbaceous Vegetation) (Taylor 1984) (n=1)

Heller Sedge-Parry Rush Herbaceous Vegetation
(*Carex helleri-Juncus parryi* Herbaceous Vegetation) (Taylor 1984) (n=1)

Timber Oatgrass-Alpine pussytoes Herbaceous Vegetation
(*Danthonia intermedia-Antennaria rosea* Herbaceous Vegetation) (n=4)

Timber Oatgrass-Sierra False Needlegrass (King's Ricegrass, Hickman 1993) Herbaceous Vegetation
(*Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation) (n=1)

Tall Mannagrass Herbaceous Vegetation
(*Glyceria striata* [*G. elata*, Hickman 1993] Herbaceous Vegetation) (n=6)

Canadian Reedgrass Herbaceous Vegetation
(*Calamagrostis canadensis* Herbaceous Vegetation) (n=6)

Black Alpine Sedge-Bog Laurel Herbaceous Vegetation
(*Carex nigricans-Kalmia polifolia* Herbaceous Vegetation) (Taylor 1984) (n=1)

Nevada Rush-Hare Sedge Herbaceous Vegetation
(*Juncus nevadensis-Carex leporinella* Herbaceous Vegetation) (n=1)

Sierra False Needlegrass Herbaceous Vegetation
(*Ptilagrostis kingii* Herbaceous Vegetation) (n=6)

Shrubby Cinqufoil/Timber Oatgrass Herbaceous Vegetation
(*Dasiphora floribunda* [*Potentilla fruticosa*, Hickman 1993]/*Danthonia intermedia* Herbaceous Vegetation) (n=3)

Canada Goldenrod-Yarrow Herbaceous Vegetation
(*Solidago canadensis-Achillea millefolium* Herbaceous Vegetation) (n=4)

Alpine Hulsea-Alpine Goldenbush-Alpine Phacelia Herbaceous Vegetation
(*Hulsea algida-Ericameria discoidea-Phacelia hastata* ssp. *compacta* Herbaceous Vegetation) (Taylor 1984) (n=1)

King's Compact Sandwort -Western Needlegrass Herbaceous Vegetation
(*Arenaria kingii* ssp. *compacta-Achnatherum occidentale* ssp. *occidentale* Herbaceous Vegetation) (n=1)

Alpine Sorrel-Lemmon's Draba Herbaceous Vegetation
(*Draba lemmonii-Oxyria digyna* Herbaceous Vegetation) (Taylor 1984) (n=1)

Mountain Pride-Shieldplant-Sierra Stonecrop-Mountain Muhly Herbaceous Vegetation
(*Penstemon newberryi-Streptanthus tortuosus-Sedum obtusatum* ssp. *boreale-Muhlenbergia montana* Herbaceous Vegetation) (Taylor 1984) (n=1)

Coville Phlox-Squirreltail-Small-flowered Fescue-Davidson Penstemon Herbaceous Vegetation
(*Phlox covillei-Elymus elymoides-Festuca minutiflora-Penstemon davidsonii* Herbaceous Vegetation) (Taylor 1984) (n=1)

Ledge Stonecrop-Watson's Spike-moss Herbaceous Vegetation
(*Rhodiola integrifolia* ssp. *integrifolia* [*Sedum roseum* ssp. *integrifolium*, Hickman 1993]-*Selaginella watsonii* Herbaceous Vegetation) (Taylor 1984) (n=1)

ALPINE ASTER HERBACEOUS ALLIANCE
(*OREOSTEMMA ALPIGENUM* var. *ANDERSONII* [*Aster alpigenus* var. *andersonii*, Hickman 1993] HERBACEOUS ALLIANCE) (n=1)

HAIRY ARNICA HERBACEOUS ALLIANCE
(*ARNICA MOLLIS* HERBACEOUS ALLIANCE) (n=1)

Broadleaf Lupine Herbaceous Vegetation
(*Lupinus latifolius* Herbaceous Vegetation) (n=4)

BISTORT HERBACEOUS ALLIANCE
(*POLYGONUM BISTORTOIDES HERBACEOUS ALLIANCE*) (Ratliff 1982, 1985) (n=4)

Western Quillwort Herbaceous Vegetation
(*Isoetes occidentalis* Herbaceous Vegetation) (n=2)

Western Quillwort-Spiked False Mannagrass Herbaceous Vegetation
(*Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation) (similar to *Torreyochloa pallida* var. *pallida-Isoetes bolanderi* of Taylor 1984) (n=1)

Narrow-leaf Bur-reed Herbaceous Vegetation
(*Sparganium angustifolium* Herbaceous Vegetation) (n=5)

YELLOW STAR-THISTLE HERBACEOUS ALLIANCE
(*CENTAUREA SOLSTITIALIS* HERBACEOUS ALLIANCE) (n=1)

Soft Chess-Ripgut Brome-Small-head Clover-American Wild Carrot
(*Bromus hordeaceus-Bromus diandrus*-(*Bromus madritensis*)-*Trifolium microcephalum-Daucus pusillus* Herbaceous Vegetation) (n=3)

### New Putative Types

The following are types with little or no sampling that as a result did not make it into the classification but were observed or expected in the Yosemite region and could be defined with sufficient sampling.

Knobcone Pine/Chamise Woodland
(*Pinus attenuata*/*Adenostoma fasciculatum* Woodland) (may include buckbrush [*Ceanothus cuneatus*])

Gray Pine-Interior Live Oak/Chamise Woodland
(*Pinus sabinana-Quercus wislizeni*/*Adenostoma fasciculatum* Woodland) (pi signature)

LIMBER PINE WOODLAND ALLIANCE
(*PINUS FLEXILIS* WOODLAND ALLIANCE) (present on east slope)

Oregon White Oak Forest

(*Quercus garryana* var. *semota* Forest)

ALPINE SAXIFRAGE HERBACEOUS ALLIANCE
(*SAXIFRAGA TOLMIEI* HERBACEOUS ALLIANCE)

YELLOW POND-LILY PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE
(*NUPHAR LUTEUM* PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE)

(WATERTHREAD PONDWEED, FINELEAF PONDWEED) PERMANENTLY FLOODED HERBACEOUS ALLIANCE
(*POTAMOGETON* (*DIVERSIFOLIUS*, *FILIFORMIS*) PERMANENTLY FLOODED HERBACEOUS ALLIANCE)

TUFTED HAIRGRASS SEASONALLY FLOODED HERBACEOUS ALLIANCE
(*DESCHAMPSIA CESPITOSA* SEASONALLY FLOODED HERBACEOUS ALLIANCE)

Tufted Hairgrass Herbaceous Vegetation (*Deschampsia caespitosa- Polygonum bistortoides* Herbaceous Vegetation) **Note:** as a result of the overlap between associations defined either from limited data or from elsewhere in the Sierra Nevada, the 13 samples collected representing this alliance were lumped into one association with *P. bistortoides* as the main indicator species. The following previously defined associations have been at least temporarily subsumed for the Yosemite classification: Tufted hairgrass-Coville ragwort (*Deshampsia caespitosa-Senecio scorzonella*) assoc. (Benedict 1983)] (N=4) 98M93, 98M82, 99K151, 99K173; Tufted hairgrass-mountain goldenrod (*Deschampsia caespitosa-Solidago multiradiata* ) assoc. (Taylor 1984)] (N=1) 99K174; Tufted hairgrass (*Descriptionhampsia caespitosa* ) assoc. (N=5) 99K107, 99K101 | 99K139, 98M8, Potter 1650; Tufted hairgrass-longstalk clover (*Deschampsia caespitosa -Trifolium longipes*) assoc. (Ratliff 1982, 1985) (N=1) 99S119; and Tufted hairgrass-Brewer bittercress assoc. (*Deschampsia caespitosa-Cardamine breweri)* (Benedict 1983) (N=2) 99S114, 99S118.

BISTORT ALLIANCE (validity of alliance is in question)
(*POLYGONUM BISTORTOIDES* HERBACEOUS ALLIANCE)

SNOW WILLOW DWARF-SHRUBLAND ALLIANCE
(*SALIX RETICULATA* ALLIANCE)

WATER SEDGE SEASONALLY FLOODED HERBACEOUS ALLIANCE
(*CAREX AQUATILIS* SEASONALLY FLOODED HERBACEOUS ALLIANCE)

Bog Blueberry Dwarf-shrubland
(*Vaccinium uliginosum* Dwarf-shrubland)

LIMBER PINE WOODLAND ALLIANCE
(*PINUS FLEXILIS* WOODLAND ALLIANCE) (stands present on east slope)

# Appendix M: Vegetation Types Without Descriptions

This appendix provides a list of associations with no descriptions in Appendix K due to an insufficient number of samples. Sample sizes are in parentheses.

## Tree associations

California Red Fir-Western White Pine/Huckleberry Oak Forest
(*Abies magnifica-Pinus monticola*/*Quercus vaccinifolia* Forest) (n=0)

Douglas-fir-White Alder Forest
(*Pseudotsuga menziesii-Alnus rhombifolia*) Forest (n=2)

Knobcone Pine/Chamise Woodland
(*Pinus attenuata*/*Adenostoma fasciculatum* Woodland) – a mapping unit (n=0)

Gray Pine/Buckbrush/Grass Woodland
(*Pinus sabiniana*/*Ceanothus cuneatus*/Grass Woodland) (n=1)

Gray Pine-Interior Live Oak/Chamise Woodland
(Pinus sabiniana-Quercus wislizeni/Adenostoma fasciculatum Woodland (n=0)

California Buckeye/Silver Lupine Woodland
(*Aesculus californica*/*Lupinus albifrons* Woodland) (n=1)

California Buckeye/Durango Root Woodland
(*Aesculus californica*/*Datisca glomerata* Woodland) (n=1)

## Shrub associations

Chamise-Whiteleaf Manzanita Shrubland
(*Adenostoma fasciculatum-Arctostaphylos viscida* Shrubland) (n=2)

Chaparral Whitethorn/Poison Oak Shrubland
(*Ceanothus leucodermis*/*Toxicodendron diversilobum* Shrubland) (n=2)

Huckleberry Oak Shrubland
(*Quercus vaccinifolia* Shrubland) (n=2)

Big Sagebrush-Rubber Rabbitbrush Shrubland
(*Artemisia tridentata-Ericameria nauseosus* Shrubland) (n=1)

Deerbrush-Whitethorn Ceanothus Stands
(*Ceanothus integerrimus-Ceanothus cordulatus* Stands) (n=2)

Oceanspray-European Red Elderberry Shrubland
(*Holodiscus discolor-Sambucus racemosa* Shrubland) (n=1)

Sierra Willow/Swamp Onion Shrubland
(*Salix orestera*/*Allium validum* Shrubland) (n=1)

Arroyo Willow-Canyon Live Oak/Spice Bush Shrubland
(*Salix lasiolepis-Quercus chrysolepis*/*Calycanthus occidentalis* Shrubland) (n=1)

Tea-leaf Willow shrubland
(*Salix planifolia* Shrubland (n=2)

## Herbaceous associations

Blue Wildrye Herbaceous Vegetation
(*Elymus glaucus* Herbaceous Vegetation) (n=1)

Purple Reedgrass-Parry Rabbitbrush-Granite Gilia Herbaceous Vegetation

(*Calamagrostis purpurascens-Chrysothamnus parryi* ssp. *monocephalus-Leptodactylon pungens* Herbaceous Vegetation) (n=1)

Condon's Sedge-European Red Elderberry Herbaceous Vegetation
(*Carex congdonii-Sambucus racemosa* Herbaceous Vegetation) (n=1)

Heller Sedge-Parry Rush Herbaceous Vegetation
(*Carex helleri-Juncus parryi* Herbaceous Vegetation) (n=1)

Heller Sedge-Silvery Buckwheat-Silky Raillardella Herbaceous Vegetation
(*Carex helleri-Eriogonum incanum-Raillardella argentea* Herbaceous Vegetation) (n=1)

Heller Sedge-Alpine Saxifrage-Woodrush Herbaceous Vegetation
(*Carex helleri-Saxifraga tolmiei-Luzula divaricata* Herbaceous Vegetation) (n=1)

Showy Sedge- Arrowleaf Ragwort Herbaceous Vegetation
(*Carex spectabilis-Senecio triangularis* Herbaceous Vegetation) (n=1)

Showy Sedge-Sibbaldia Herbaceous Vegetation
(*Carex spectabilis-Sibbaldia procumbens* Herbaceous Vegetation) (n=2)

Timber Oatgrass-Sierra False Needlegrass (King's Ricegrass, Hickman 1993) Herbaceous Vegetation
(*Danthonia intermedia-Ptilagrostis kingii* Herbaceous Vegetation) (n=1)

Shorthair Reed Grass-Drummond Rush Herbaceous Vegetation
(*Calamagrostis breweri-Juncus drummondii* Herbaceous Vegetation) (n=1)

Nevada Rush - Hare Sedge Herbaceous Vegetation
(*Juncus nevadensis-Carex leporinella* Herbaceous Vegetation) (n=1)

Parry Rush-Red Mountainheather Herbaceous Vegetation
(*Juncus parryi-Phyllodoce breweri* Herbaceous Vegetation) (n=1)

King's Compact Sandwort-Western Needlegrass Herbaceous Vegetation
(*Arenaria kingii compacta-Achnatherum occidentale* Herbaceous Vegetation) (n=1)

Alpine Sorrel-Lemmon's Draba Herbaceous Vegetation
(*Oxyria digyna-Draba lemmonii* Herbaceous Vegetation) (n=1)

Alpine Hulsea-Alpine Goldenbush-Alpine Phacelia Herbaceous Vegetation
(*Hulsea algida-Ericameria discoidea-Phacelia hastata* var. *compacta* Herbaceous Vegetation) (n=1)

Ledge Stonecrop-Watson's Spike-moss Herbaceous Vegetation
(*Rhodiola integrifolia* ssp. *integrifolia-Selaginella watsonii* Herbaceous Vegetation) (n=1)

Mountain Pride-Shieldplant-Sierra Stonecrop-Mountain Muhly Herbaceous Vegetation
(*Penstemon newberryi-Streptanthus tortuosus-Sedum obtusatum* ssp. *boreale-Muhlenbergia montana* Herbaceous Vegetation) (n=1)

Coville Phlox-Squirreltail-Small-flowered Fescue-Davidson Penstemon Herbaceous Vegetation
(*Phlox covillei-Elymus elymoides-Festuca minutiflora-Penstemon davidsonii* Herbaceous Vegetation) (n=1)

Western Quillwort Herbaceous Vegetation
(*Isoetes occidentalis* Herbaceous Vegetation) (n=2)

Western Quillwort-Spiked False Mannagrass Herbaceous Vegetation
(*Isoetes occidentalis-Torreyochloa erecta* Herbaceous Vegetation) (n=1)

# Appendix N: Types in the Preliminary Classification but not in the Final Classification due to Insufficient Sampling

This appendix provides a list of associations previously described by other authors and included in the preliminary classification but not incorporated into the final classification for Yosemite National Park and its environs for lack of samples.

## Tree associations

### *Forests*

Canyon Live Oak/Narrow-leaf Fern Forest (Sawyer and Stillman, 1977)
(*Quercus chrysolepis*/*Dryopteris* Forest)

Sierra Lodgepole Pine/Fendler Meadow-rue Forest (Taylor, 1984)
(*Pinus contorta* var. *murrayana*/*Thalictrum fendleri* Forest) (incorporated into *Pinus contorta* var. *murrayana*/*Ligusticum grayi* Forest; Potter, 1998)

Mountain Hemlock/Heartleaf Arnica Forest (Taylor, 1984)
(*Tsuga mertensiana*/*Arnica cordifolia* Forest)

White Alder/Indian Rhubarb Forest (Potter, 2000, 2005)
(*Alnus rhombifolia*/*Darmera peltata* Forest)

Whitebark Pine/Wheeler Bluegrass Forest (Taylor, 1984)
(*Pinus albicaulis*/*Poa wheeleri* Forest)

### *Woodlands*

California Black Oak Woodland (Keeler-Wolf, 1987)
(*Quercus kelloggii* Woodland)

Blue Oak-Valley Oak/Grass Woodland (Allen et al., 1991)
(*Quercus douglasii*-*Quercus lobata*/Grass Woodland) (no local occurrence)

## Shrub associations

Arctic Willow Dwarf-shrubland (Taylor, 1984)
(*Salix arctica* Dwarf-shrubland)

Sierra Bilberry-Blackish Sedge Dwarf-shrubland (Major and Taylor, 1977)
(*Vaccinium caespitosum*-*Carex nigricans* Dwarf-shrubland)

Oceanspray/Suksdorf Monkeyflower Shrubland (Taylor, 1984)
(*Holodiscus discolor*/*Mimulus suksdorfii* Shrubland)

Timberline sagegrush/Sierra beardtongue Herbaceous Vegetation (Benedict, 1983)
(*Artemisia rothrockii*/*Penstemon heterodoxus* Shrubland)

Shrubby Cinquefoil Shrubland (Burke, 1982)
(*Dasiphora floribunda* Shrubland)

## Herbaceous associations

Alpine Timothy-One-spike Oatgrass Herbaceous Vegetation (Taylor, 1984)
(*Phleum alpinum*-*Danthonia unispicata* Herbaceous Vegetation)

Blue Wildrye-Cow Parsnip Herbaceous Vegetation (Halpern, 1986)
(*Elymus glaucus*-*Heracleum lanatum* Herbaceous Vegetation )

Coville ragwort-Showy Sedge Herbaceous Vegetation (Burke, 1982)

(*Senecio scorzonella-Carex spectabilis* Herbaceous Vegetation

Carpet Clover Herbaceous Vegetation (Ratliff, 1982, 1985)
(*Trifolium monanthum* Herbaceous Vegetation)

Cordilleran arnica-Davidson arabis Herbaceous Vegetation (Taylor, 1984)
(*Arnica mollis-Arabis davidsonii* Herbaceous Vegetation )

Gentian-Alpine Aster Herbaceous Vegetation (Ratliff, 1982, 1985)
(*Gentiana newberryi-Oreostemma alpigenum* Herbaceous Vegetation)

Longstalk Clover Herbaceous Vegetation (Ratliff, 1982, 1985)
(*Trifolium longipes* Herbaceous Vegetation)

Lemmon Needlegrass-Mt. Shasta Sedge Herbaceous Vegetation (Taylor, 1984)
(*Achnatherum lemmonii-Carex straminiformis* Herbaceous Vegetation)

Many-nerved Sedge-Yarrow Herbaceous Vegetation (Benedict, 1983)
(*Carex heteroneura-Achillea millefolium* Herbaceous Vegetation )

Merten Rush Herbaceous Vegetation (Taylor, 1984)
(*Juncus mertensianus* Herbaceous Vegetation)

Mount Dana Sedge-Alpine Shooting Star Herbaceous Vegetation (Taylor, 1984)
(*Carex incurviformis var. danaensis-Dodecatheon alpinum* Herbaceous Vegetation)

Mount Dana Sedge-Little Elephant's Head Herbaceous Vegetation (Major and Taylor, 1988)
(*Carex incurviformis var. danaensis-Pedicularis attolens* Herbaceous Vegetation)

Mountain Spikerush-Moss Herbaceous Vegetation (Halpern, 1986)
(*Eleocharis montevidensis*-Moss Herbaceous Vegetation )

Nebraska Sedge-Sierra Ricegrass Herbaceous Vegetation (Halpern, 1986)
(*Carex nebrascensis-Ptilagrostis kingii* Herbaceous Vegetation )

One-spike Oatgrass-King Ricegrass-Coville Ragwort Herbaceous Vegetation (Taylor, 1984)
(*Danthonia unispicata-Ptilagrostis kingii-Senecio scorzonella* Herbaceous Vegetation)

Rocky Mountain Sedge-Elephanthead Lousewort Herbaceous Vegetation (Taylor, 1984)
(*Carex scopulorum-Pedicularis groenlandica* Herbaceous Vegetation )

Rocky Mountain Sedge-Cottongrass Herbaceous Vegetation (Taylor, 1984)
(*Carex scopulorum-Eriophorum criniger* Herbaceous Vegetation )

Rocky Mountain Sedge-Few-flowered Spikerush Herbaceous Vegetation (Taylor, 1984)
(*Carex scopulorum-Eleocharis pauciflora* Herbaceous Vegetation )

Rough Bentgrass Herbaceous Vegetation (Halpern, 1986)
(*Agrostis scabra* Herbaceous Vegetation)

Shorthair Reedgrass-Mountain Laurel Herbaceous Vegetation (Taylor, 1984)
(*Calamagrostis breweri-Kalmia polifolia* Herbaceous Vegetation)

Shorthair Sedge-Sierra Saxifrage (Taylor, 1984)
(*Carex exserta-Saxifraga aprica* Herbaceous Vegetation)

Sierra Claytonia Herbaceous Vegetation (Taylor, 1984)
(*Claytonia nevadensis* Herbaceous Vegetation )

Tall Mannagrass-Small-fruited Bulrush Herbaceous Vegetation (Halpern, 1986)
(*Glyceria stricta- Scirpus microcarpus* Herbaceous Vegetation )

Tall Mannagrass-Streambank Bird's-foot Trefoil Herbaceous Vegetation (Halpern, 1986)

(*Glyceria stricta-Lotus oblongifolius* Herbaceous Vegetation )

Tilling Monkeyflower/One-sided Bluegrass (Taylor, 1984)
(*Mimulus tilingii-Poa secunda* ssp. *secunda* Herbaceous Vegetation)

Tufted Hairgrass-Brewer's Bittercress Herbaceous Vegetation (Benedict, 1983)
(*Deschampsia cespitosa-Cardamine breweri* Herbaceous Vegetation)

Tufted Hairgrass-Coville Ragwort Herbaceous Vegetation (Benedict, 1983)
(*Deschampsia cespitosa-Senecio* scorzonella-Herbaceous Vegetation)

Tufted Hairgrass-Coville Ragwort-Yarrow Herbaceous Vegetation (Benedict, 1983)
(*Deschampsia cespitosa- Senecio scorzonella-Achillea millefolium* Herbaceous Vegetation)

Tufted Hairgrass- Coville Ragwort Herbaceous Vegetation (Benedict, 1983)
(*Deschampsia cespitosa-Senecio scorzonella* Herbaceous Vegetation)

Vernacular Sedge-Alpine Pussytoes Herbaceous Vegetation (Taylor, 1984)
(*Carex vernacula-Antennaria media* Herbaceous Vegetation)

Western Yellow Cress-Dewey Sedge Herbaceous Vegetation (Taylor, 1984)
(*Rorippa curvisiliqua-Carex deweyana* Herbaceous Vegetation)

Western Needlegrass-Nude Buckwheat Herbaceous Vegetation (Taylor, 1984)
(*Achnatherum occidentale-Eriogonum nudum* Herbaceous Vegetation)

### Habitats – Alpine and Subalpine

Streambank Arnica-Congdon Sedge Herbaceous Vegetation (Taylor, 1984)
(*Arnica amplexicaulis-Carex congdonii* Herbaceous Vegetation)

Nuttall's Sandwort Herbaceous Vegetation (Taylor, 1984)
(*Minuartia nuttallii* Herbaceous Vegetation)

Nested Saxifrage-Pullup Muhly Herbaceous Vegetation (Taylor, 1984)
(*Saxifraga nidifica-Muhlenbergia filiformis* Herbaceous Vegetation)

Moss Saxifrage Herbaceous Vegetation (Taylor, 1984)
(*Saxifraga bryophora* Herbaceous Vegetation)

Alpine Smartweed Herbaceous Vegetation (Taylor, 1984)
(*Polygonum minimum* Herbaceous Vegetation)

Heller Sedge-Club-moss Ivesia Herbaceous Vegetation (Taylor, 1984)
(*Carex helleri-Ivesia lycopodioides* Herbaceous Vegetation)

Alpine Alumroot-Fragile Fern Herbaceous Vegetation (Taylor, 1984)
(*Heuchera rubescens-Cystopteris fragilis* Herbaceous Vegetation)

Granite Mousetail Herbaceous Vegetation (Taylor, 1984)
(*Ivesia muirii* Herbaceous Vegetation)

Coville's Phlox-Frosted Buckwheat Herbaceous Vegetation (Taylor, 1984)
(*Phlox covillei-Eriogonum incanum* Herbaceous Vegetation)

Dense Draba-Sweetwater Mountain Milkvetch Herbaceous Vegetation (Taylor, 1984)
(*Draba densifolia-Astagalus kentrophyta* Herbaceous Vegetation)

# Appendix O: Yosemite Mapping Class Descriptions

The following descriptions of mapping classes include the photointerpretation (PI) code, the type name in English, type name using species' scientific names, comments on occurrence (optional), important taxa occurring in the type, habitat characteristics, a listing of types that can be mistaken for the present class during photointerpretation, and notes on key photo signatures. Information on habitat characteristics is organized by the following categories: microclimate, elevation (largely by the ecological zones described on page 5), soil, aspect, slope shape, slope position, slope steepness, hydrology, fire, and frequency. Information for each of these habitat characteristics was not universally available. The exceptions are the descriptions for sparsely vegetated/miscellaneous classes for which we provide brief, descriptive paragraphs of each mapping class. The description for class 0990, urban/developed, includes a list of land use codes assigned to each polygon interpreted as urban/developed, e.g., 421, hotels/lodges, and 462, picnic areas and associated parking.

Note: Type codes and names in regular text occur in the PIFinal field. Those limited to the PIPreFinal and PIOriginal fields in the map are in gray text.

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# 0000 - Sparsely Vegetated/Miscellaneous Classes

## 0100 - Alpine Talus Slope (Zones 5 & 6)

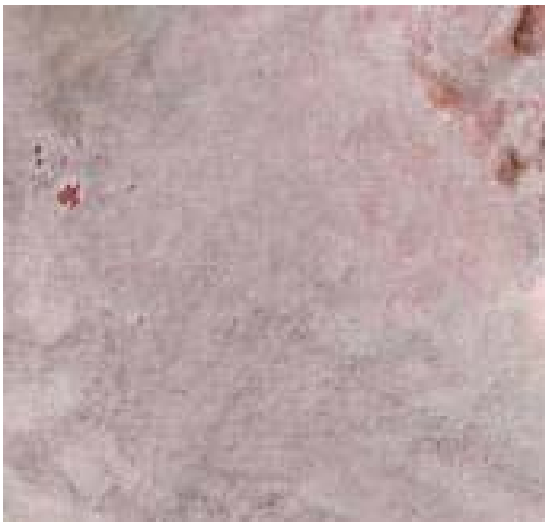
**100 Alpine Talus Slope**

A west facing example with little IR signature, this talus slopes has a fairly wide range in boulder size.

0101 - Alpine Talus Slope - Concave Northerly
0102 - Alpine Talus Slope - Concave Southerly
0103 - Alpine Talus Slope - Convex Northerly
0104 - Alpine Talus Slope - Convex Southerly

Note: Codes 0101 to 0104 were aggregated to type 0100 in PIFinal field

## **0200 - Alpine Scree Slope** (Zones 5 & 6)



**0200 – Alpine Scree Slope**

A gently sloping rather densely vegetated example trending southwest. Scree slopes generally yield a higher infra-red vegetation signature than talus.

0201 - Alpine Scree Slope - Concave Northerly
0202 - Alpine Scree Slope - Concave Southerly
0203 - Alpine Scree Slope - Convex Northerly
0204 - Alpine Scree Slope - Convex Southerly
Note: Codes 0201 to 0204 were aaggregated to type 0200 in PIFinal field

## Alpine Talus and Scree Mapping Units

Mapping Units are used where Alliances or Associations cannot be identified or aggregated reliably from photointerpretation. The Alpine Talus (0100's) and Scree (0200's) mapping units are applied only in the alpine zone (Zones 5 and 6). Non-Alpine Talus (0950) is not mapped in Zones 5 and 6.

Photo Signature - The use of texture and color (reflectance) are the main guidelines in differentiating Talus, Scree, and Boulder Fields (code 0700). Scree slopes are mapped where texture on the aerial photography is smooth to the point that individual rocks generally cannot be observed. Using the scale of the aerial photography (1:15,840) this equates to approximately 30 cm minimum resolution. A slight over-mapping of scree slopes may result, but overall will most likely prove sufficient in dividing the two rock types. Photo signature may also be influenced by a number of variables including soil/rock color, geologic rock type, rock size/shape, amount of vegetation, overall aspect and proximity to edge of photo.

Photo Signature Texture:

- Talus – Moderately coarse texture
- Scree – Fine texture
- Boulder Field – Extremely coarse (>1-2 meters) texture

Photo Signature Color:

- Talus & Boulder Field - Dark gray indicates bouldery (shadowy=less reflectance). Includes snow covered Talus and Boulder Fields that are not identified on the topo as permanent snowfield/glacier.
- Scree - Medium gray indicates cobbly, err toward Scree
- Scree - Light gray to white indicates cobbly (parallel flat-lying rocks with increased reflectance)

Aspect - Direction in which the slope trends (aspect) in Zone 5 & 6 may be important in refining the associations found on scree or talus, but on a more regional perspective. Aspects can be influenced by its position on a slope and its orientation in regards to adjacent hillsides, which may influence the amount of solar radiation that a particular area receives. Since aspect is a somewhat more dubious factor locally, talus and scree slopes are divided more generally; polygons under approximately 10 acres in size are not separated out. Aspect is mapped reflecting two criteria (northerly, southerly) based on amount of solar radiation the slope receives. Slopes trending northward in any direction are labeled as a north trending aspect, slopes trending southward in any direction are labeled as a south trending aspect with a slight emphasis on west facing slopes towards the south, and east facing slopes towards the north.

Aspect:

Northerly – N, NE, NW, E  Southerly – S, SE, SW, W

Slope Shape - Whether a slope is convex or concave can be important in refining what vegetation types may occur on the scree or talus. In general, convex shaped slopes tend to hold less moisture and may support xeric type communities, i.e., plants that reflect more xeric settings such as phlox or goldenbush. Concave settings tend to gather more moisture and may support plants with more mesic requirements such as elderberry. Slope shape is mapped with regards to

how it occurs locally and to what is seen on a “micro” scale. For example, mapping slope shape on a cirque (concave) and labeling it concave would be considered too general. Therefore, the entire slope on the cirque is reviewed and a determination is made on whether that unit is locally convex or concave and whether it can be further divided into distinct mapping units.

Often, the shape of a particular scree or talus slope is highly complex and variable. Every effort is made to determine slope shape on a local level (as described above). Complexes within the overall mapping unit are averaged so that no polygon below approximately 5-10 acres in size is separated out on slope shape alone.

Slope Shape:

Convex – Curved or rounded outward
Concave – Curved or rounded inward

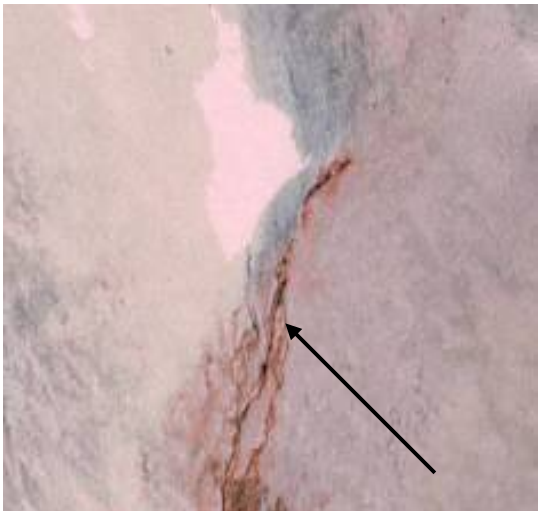
Vegetation Density - In general, Scree and Talus contain a sparse canopy of vegetative cover, usually below 25% absolute cover. Many slopes as viewed on the aerial photography contain no visible IR reflectance. Therefore, an additional range value was added for use only on these sparsely vegetated slopes. Density category 6 (0-2%) is used when no visible IR signature is detectable on the aerial photography. This helps separate out the few slopes where a visible IR signature denotes more extensive stands of vegetation that in turn may form alliances and/or associations. Variability of vegetation density within the scree or talus slope is addressed on a more detail level than aspect and slope shape since it involves a visible CIR signature. Density may further divide the Mapping Units based on vegetative signature.

Photo Signature Color:

No pink indicates 0-2% density of vegetated cover
Scattered patches of pink indicate 2-10% density of vegetated cover
Continuous uneven pink indicates 10-25% density of vegetated cover
Continuous even pink indicates >25% density of vegetated cover

## **0300 - Alpine Snow Patch Communities** (Zones 5 & 6)

Snow covered areas containing herbaceous vegetation saturated from the presence of late lying snow, usually below the existing snow patch. This community will be mapped in areas of late lying snow, as seen on the August 1997 aerial photography. Polygons will be extended slightly downslope of the existing snow patch to include saturated conditions as visible on the CIR. Often this will include small linear rivulets that may trail below the snow patch itself. Permanent Snowfields/Glaciers as identified on the topo will be differentiated from Snow Patch Community snow covered areas. Vegetation densities are not assigned to these polygons.



**300 – Alpine Snow Patch Communities**

## **0500 - Mesic Rock Outcrop** (Upper Zone 4, Zones 5 & 6)

Rock outcrops generally containing less than 10% absolute vegetative cover, usually northerly trending in aspects, may be southerly where vegetation appear clearly mesic or wet (brighter pink to red signature) on the aerial photography. North trending outcrops that are more unconsolidated in nature where vegetation is not visible on the CIR will be presumed mesic but extremely sparse and therefore will fall into this category. This type does not include Cliffs. Outcroppings that usually trend south containing a vegetation signature which tends to be brown or tan (possibly Holodiscus sp. Or Bush Cinquefoil) will be lumped into the more general rock outcrop (0961) type. Vegetation densities are not assigned to mesic rock outcrop polygons.

**500 – Mesic Rock Outcrop**
Sparsely vegetated locally patchy and at times locally dense vegetation within bedrock outcrops. Vegetation is usually but not limited to herbaceous species.

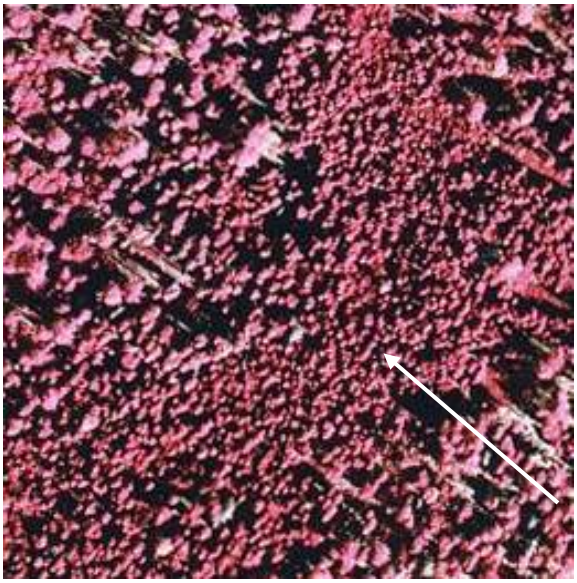
**700 – Boulder Field**

## **0700 - Boulder Field** (Zones 5 & 6)

Boulder Fields are mapped when rock size averages 1-2 meters in size or greater (about the size of a "period" denoted on this document). The use of photo signature texture and color (reflectance) are the main variables used in differentiating Boulder Fields from Talus (0100's) and Scree (0200's). A Boulder Field photo signature has an extremely coarse texture and dark gray color, and may include snow areas that are not identified on the topo as permanent snowfield/glacier.

## **0900 - Sparsely Vegetated/Miscellaneous Classes (continued)**

### 0910 - Conifer Reproduction



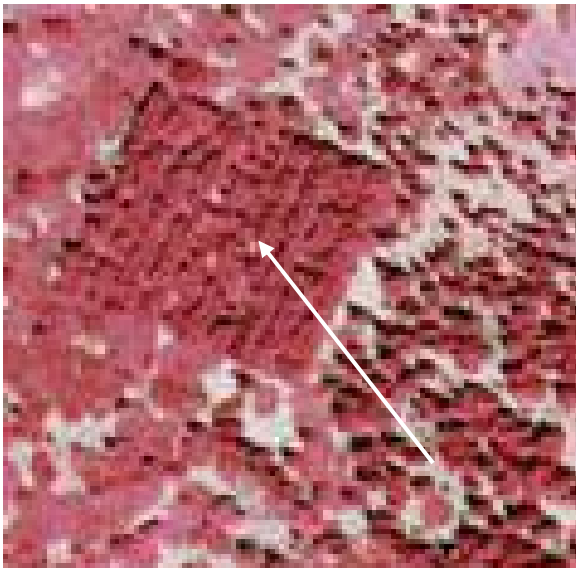
**910 - Conifer Reproduction**

A dense young conifer opening (probably white fir and sugar pine) depicting a post fire setting north of the Crane Flat Road about 5 miles south of Crane Flat Meadow.

Young post-avalanche conifer stands that represent avalanche areas and post-fire conifer stands that represent burn areas with conifer re-growth. In the 1997 aerial photography, the conifers are too small to identify the species type and/or the understory shrub cover does not fit into an existing association.

## 0920 - Conifer Plantation

Plantations are composed of a group of planted trees usually of a single species. Tree patterns may be even rows and most plantation areas contain numerous roads for access.



**920 – Conifer Plantation**

## 0940 - Sparsely Vegetated Undifferentiated

Non-vegetation undifferentiated areas have less than 2% vegetative cover. This category is used for those naturally non-vegetated areas that do not fit into any of the other more detailed non-vegetated Miscellaneous Classes or Rock Outcrop types. The photo signature typically appears white on the 1997 CIR photos.

## 0941 - Sparsely Vegetated Riverine Flat

Non-vegetated riverine flats are naturally barren areas found along the shoreline of rivers and streams. These areas appear white on the CIR photos and contain less than 2% vegetative cover.

## 0950 - Non-Alpine Talus (Zones 1-4,7-8)

Talus areas with less than 2% vegetative cover comprised of coarse rock fragments usually lying at the base of a cliff or steep slope. Signature is gray. Talus in alpine areas (Zones 5 and 6) is mapped using the alpine type classes (see codes 0100 through 0500).

## 0960 - Rock Outcrop Undifferentiated

## 0961 - Sparsely Vegetated to Non-Vegetated Exposed Rock (Zones 1 thru 8)

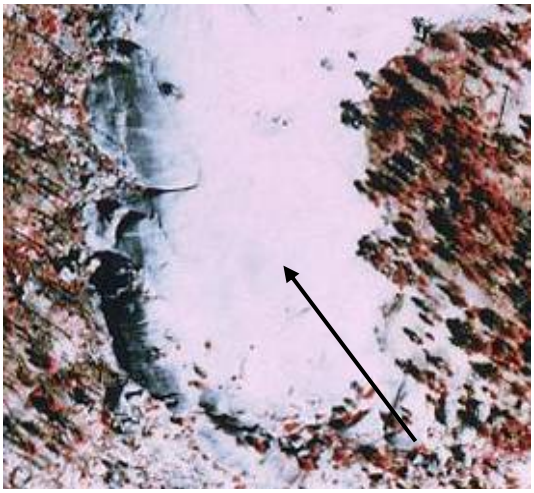
Rock outcrops containing less than 2-5% absolute vegetative cover in a wide range of slope positions and steepness (including cliffs). The photo signature is white to dark gray. Exposed rock not displaying a visibly bright IR signature in Zone 5 and 6 are included. Alpine Mesic Rock Outcrops in Upper Zone 4 and Zones 5 and 6 are a separate class (0500). In the future the Digital Elevation Models (DEMs) can be used by the park to further differentiate Exposed Rock Outcrop into consistent steepness categories.

**961 – Rock Outcrop**

This example is a steep cliff face just north of the Big Oak Flat Road.

## 0963 - Dome

Domes are smooth rounded landforms consisting of bedrock with less than 2% vegetative cover. The signature is typically white to light gray.



**963 – Dome**

A small dome just north of Wildcat Creek.

## 0964 - Fissured Rock Outcrop

**964 – Fissured Rock Outcrop**

Depicting numerous breaks in the rock where small carex meadows are too small to individually map.

A fissured rock outcrop is a rock outcrop with extensive cracks or fractures in the rock. Vegetation is evident within the fissures, but the map unit contains less than 2% absolute vegetative cover. The vegetation within the fissures are less than the minimum mapping unit width.

## 0965 - Sparsely Vegetated Rocky Streambed

A streambed on rock outcrop, where there is little or no unconsolidated material within the streambed. The streambed is unvegetated. Photo signature is white. Streambed path is usually steep with waterfalls.

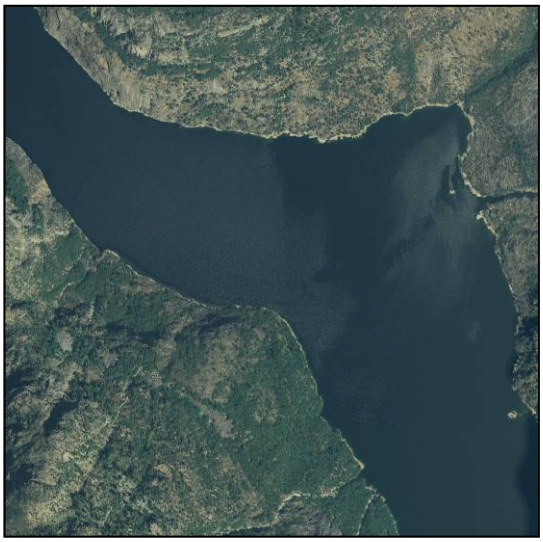
## 0970 - Alpine Permanent Snowfield/Glacier

**970 = Alpine Snowfield / Glacier**

The permanent snowfield/glacier class is mapped using the snowfield and glacier map units found on the USGS 1:24,000 scale topographic sheets. Polygon boundaries are rectified to the 1997 CIR photography. Polygons are then readjusted to the DOQQ's to ensure that no portion of the polygon goes beyond the most recent snow line as depicted on the DOQQ image. This results in a change from the original interpretation found on the USGS 1:24000 maps.

## 0980 - Water

**0980 = Water (Hetch Hetchy Reservoir)**



Water bodies and rivers typically have a dark blue to black signature on the aerial photography. Portions of the rivers may appear dry (white to gray signature) due to the mid-summer dry conditions of the aerial photography.

### 0981 - Permanently Flooded, Emergent or Floating Vegetation Mapping Unit

Submerged or floating vegetation units within a water body that are evident on the aerial photography will be mapped in this miscellaneous category. Typically these types occur below the minimum mapping unit (0.5 hectare).

## 0990 - Urban/Developed

**0990 = Urban/Developed – (Yosemite Valley)**

All urban/developed or human-disturbed areas with less than 2% absolute vegetative cover are mapped in this class. Vacant areas created by human activity, such as road cuts and cleared areas, are included in the urban/built-up category. See the Land Use layer for more detailed land use designations of built-up features (e.g. residential, commercial, park facility).

**100 - Urban/Developed (Outside of the Park and Private In-Holdings)**
- 110 - Residential
- 120 - Commercial
- 130 - Industrial
- 140 - Transportation/Utility/Communication
- 150 - Recreation

**200 - Agriculture (Outside of the Park and Private In-Holdings)**
- 210 - Plantations
- 220 - Other Agricultural Land

**300 - Mining (Outside of the Park and Private In-Holdings)**

**400 - National Park Facilities (Within the Park Except Private In-Holdings)**
- 410 - Residential
- 420 - Commercial
  - 421 - Hotels/Lodges

422 - Commercial/Concessions (including shops, restaurants, visitor center)
430 - Administration/Offices
431 - Administrative Offices/Research Facilities/Other Services
432 - Park Entrance
433 = Restoration
434 = Museum
440 - Industrial
441 - Maintenance Shops
450 - Transportation/Utility/Communication
451 - Sewage Treatment Facilities
452 - Water Storage Facilities
453 - Water Treatment Facilities
454 - Electrical Power Facilities
455 - Communication Facilities
456 - Major Day Use Parking Areas
457 - Dams
460 - Recreation
461 - Ski Areas
462 - Picnic Areas and Associated Parking
463 - Campgrounds (non-primitive) and Associated Parking
464 - Tent Cabins and Associated Parking
465 - Golf Course
466 - View Point Area and Associated Parking
467 - Stables and Associated Facilities
468 - Ice Rink and Associated Parking
469 = Firing Range
470 - Mining/Borrow Pits
**800 - Open Water**
**900 - Vacant**

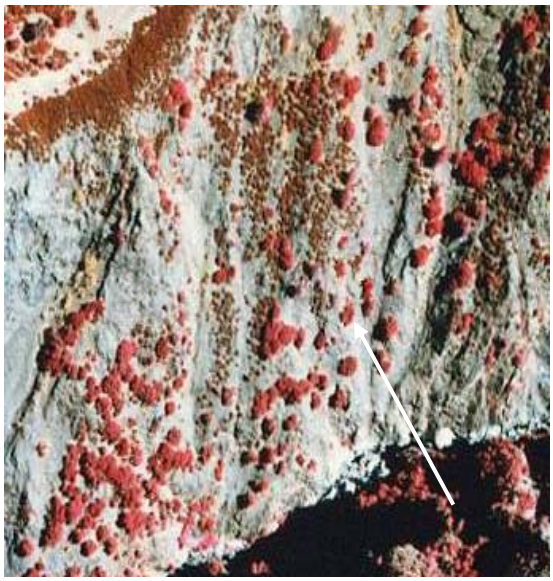
# 1000 - Broadleaf Evergreen Trees

## 1020 - Canyon Live Oak Forest Alliance (Zone 1 & 2)
***Quercus chrysolepis* Forest Alliance**

### 1022 - Canyon Live Oak/Whiteleaf Manzanita Forest Association (Zone 2)
***Quercus chrysolepis/Arctostaphylos viscida* Forest Association**

Noted on south-facing cliffs in Yosemite Valley above cold air drainage valley floor and below the higher elevations approaching Zone 3. Also seen on rocky exposures near Hetch Hetchy.

Taxa - Open stands of canyon live oak at a minimum of 5-10% as an emergent to whiteleaf manzanita. Manzanita understory is generally extremely sparse, but at times can be locally patchy in dense stands throughout the polygon.
Microclimate – Xeric
Elevation – Uppermost portions of Zone 1 to lower portions of zone 3
Soil – Poorly developed to rocky
Aspect – Southerly
Shape – Convex
Slope Position – Lower, mid and upper
Steepness - Fairly steep slopes and shallower slopes with high degree of exposed bedrock, on a shallow soil
Hydrology – Upland
Frequency – common, at times extensive



**1022 - Canyon Live Oak / Whiteleaf Manzanita Forest Association**

Note bright IR signature of the canyon live oak contrasting to the adjacent rock. whiteleaf manzanita scattered and locally patchy in stand.

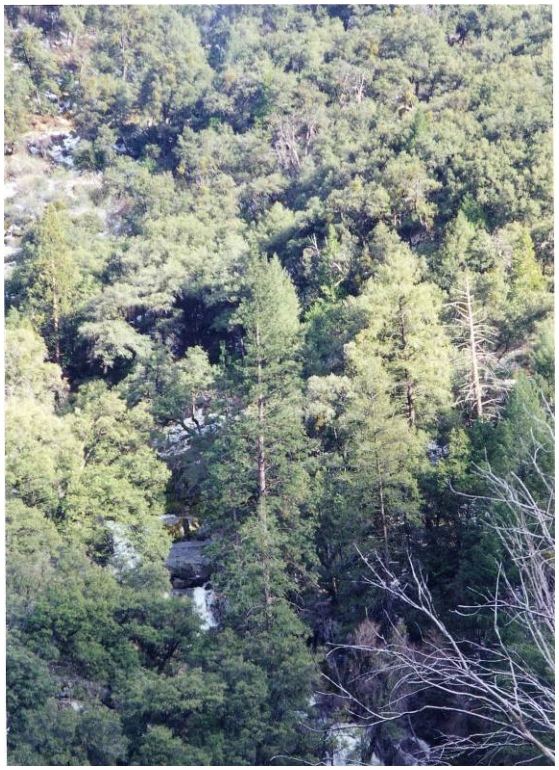
Note, the following similar map units can be confused with this type:

- Less xeric expressions of the interior live oak/whiteleaf manzanita woodland association (1042) are generally separable by elevation (south facing slopes up to 3000 feet, on northerly aspects they may separate out as low as 2000 feet).
- Canyon Live Oak-Gray Pine Forest Association (1026) – is usually more sparse, and with a minimum of approximately 3% gray pine present.
- Canyon Live Oak/Greenleaf Manzanita Forest (1029) – is higher in elevation, more mesic, with possibly more dense canyon live oak and manzanita.

Key Photo Signature Notes: Stands often noted in sparse settings where canyon live oak contrasts sharply with the adjacent rock outcroppings. Bright red signature of the canyon live oak generally contrasts with the understory whiteleaf manzanita that reflects less IR.

## 1023 - Canyon Live Oak-(Ponderosa Pine-Incense-cedar) Forest Superassociation (Zone 2)

***Quercus chrysolepis-(Pinus ponderosa -Calocedrus decurrens)* Forest Superassociation**



**1023 - Canyon Live Oak-(Ponderosa Pine-Incense-cedar) Forest Superassociation**

Note Dense stands of canyon live oak in mesic settings with locally emergent ponderosa pine scattered throughout but increasing towards the southeast.

Seen as dense stands of canyon live oak (>75% crown cover) with sparse emergent ponderosa pine (minimum 3-5% relative cover up to 10-20%) especially by the riparian zones at the lower elevations near the Arch Rock park entrance. In Zone 2 seen on steep northwesterly expressions.

Associations: Canyon Live Oak-Ponderosa Pine Forest Association, Canyon Live Oak-Incense-cedar Forest Association.

Taxa - Dense stands of canyon live oak (>75% crown cover) with emergent ponderosa pine and or incense-cedar with a minimum of 3-5% relative cover.
Microclimate – Generally mesic in Zone 1, submesic in Zone 2
Elevation – Higher portions of Zone 1 and most of Zone 2
Soil – Moderately developed to rocky
Aspect – Zone 1 northerly, Zone 2 south and southwest.
Shape – Zone 1 convex or concave, Zone 2 convex
Slope Position – Zone 1 lower only, Zone 2 mid and upper slopes
Steepness – Usually fairly level to moderately steep in Zone 1, and moderately steep in Zone 2.
Hydrology – Upland
Frequency – Fairly common but not extensive

Note, the following similar map units can be confused with this type:

- Ponderosa Pine-Incense-cedar-Canyon Live Oak/Mountain Misery Forest Association (3061) – has an open canopy of canyon live oak with at least a 40% cover of ponderosa pine. Type 3061 is significantly drier than 1023, occurs at somewhat higher elevations and has significantly less canyon live oak canopy cover.
- Canyon Live Oak-California Bay Forest Association (1024) – also dense, but no emergent ponderosa pine. Often occurs adjacent, usually upslope from 1023.
- Douglas-fir/Canyon Live Oak Forest Association (4012) is generally found on steeper north trending protected slopes.

Key Photo Signature Notes: Dense stands of canyon live oak in mesic settings generally yield a very bright IR signature; overall texture is smooth to slightly lumpy. Emergent ponderosa pine are visible in stereo, and generally tend to have a rounded crown.

## 1024 - Canyon Live Oak-California Laurel Forest Association (Zone 2)

***Quercus chrysolepis-Umbellularia californica* Forest Association**

California Bay can be a very minor component in the canopy and is indiscernible on the aerial photos. Noted on steep north facing slopes in extensive stands south of the Merced River from El Portal to Yosemite Valley. At higher elevations, stands take on more southerly exposures on low slopes protected partially by adjacent topography.

Taxa – Canyon live oak dominant with closed canopy (>75% crown cover), with a minimum of 1-5% California bay.
Microclimate – Mesic
Elevation – Upper portions of Zone 1 and most of Zone 2
Soil – Well developed (supporting Fern understory); or less well developed to rocky (supporting Bay)
Aspect – Generally northerly in Zone 1, but more widespread in Zone 2 occupying all aspects
Shape – Generally more common as concave, but can be convex in the rocky and talus areas
Slope Position – Generally lower to mid slopes.
Steepness – Moderately steep to steep
Hydrology – Upland
Frequency – Fairly common, variable in size

Note, the following similar map units can be confused with this type:

- Canyon Live Oak-Ponderosa Pine Forest Association (1023) – has minimum 3 to 5% ponderosa pine as an emergent.

- Interior Live Oak-Canyon Live Oak Woodland Association (1043) – occurs in more mesic situations, primarily below 3000 feet. Usually associated with drier fringes of riparian zones.
- Douglas-fir–Canyon Live Oak Forest Association (4012) occurs in similar settings, but at slightly higher elevations and has a minor component of Douglas-fir.

Key Photo Signature Notes: Note bright IR reflectance values of the canyon live oak, nearly always dense stands unless interrupted by talus openings. Canyon live oak yields a somewhat deeper red signature than California black oak. Texture is variable but generally similar throughout the stand.

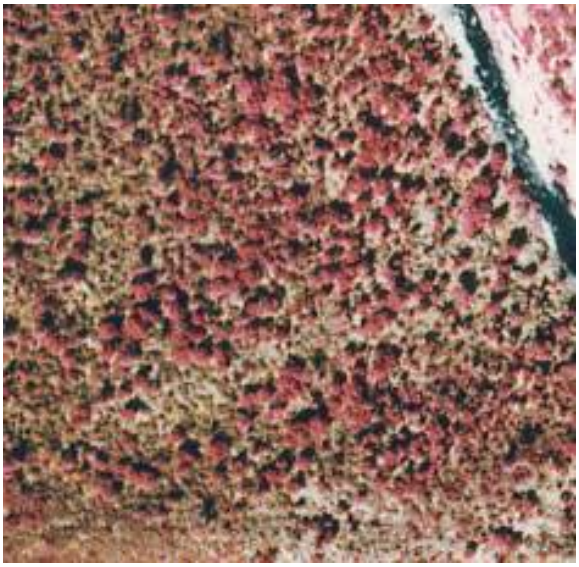
**1024 – Canyon Live Oak – California Laurel Forest Association**

High IR reflectance in dense mesic stands of canyon live oak. Note in this scene, dense canyon live oak alternates with talus slopes on south slopes just above the Merced River.

## 1026 - Canyon Live Oak-Gray Pine Forest Association (Zone 1)
***Quercus chrysolepis-Pinus sabiana* Forest Association**

Fairly extensive stands seen on the road to the Hetch Hetchy reservoir in extremely rocky environments with little soil development. It was noted that the canyon live oak replaced the interior live oak in this area because of its higher elevation (>3000 feet).

Taxa – Canyon live oak and gray pine occurring (each with 5-25% crown) as a sparse overstory to a sparse shrub understory of mainly whiteleaf manzanita. May occur without whiteleaf manzanita; occasionally occurs with canyon live oak densities of >50%.
Microclimate – Xeric to extremely xeric
Elevation – Uppermost portion of Zone 1 and lower portions of Zone 2
Soil – Minimal, poorly developed and rocky
Aspect – Generally southerly but variable
Shape – Convex
Steepness – Moderately steep to steep
Geology – n/a
Hydrology – Upland
Frequency – Fairly common and often extensive



**1026 – Canyon Live Oak – Gray Pine Forest Association**

In this stand, canyon live oak and gray pine occur with an understory of whiteleaf manzanita in a denser than average setting. Low elevation example trending northeasterly.

Note, the following similar map units can be confused with this type:

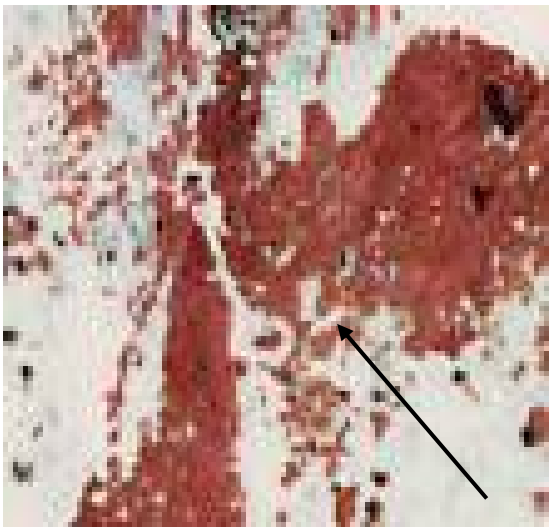
- Gray Pine–Interior Live Oak/Whiteleaf Manzanita Woodland Association (3092) can be separated out for the most part based on elevation and aspect (below 3000 feet).
- Canyon Live Oak/Whiteleaf Manzanita Forest Association (1022) – is usually not as sparse, and will have little or no gray pine (<3% relative cover).

Key Photo Signature Notes: Canyon live oaks have a rounded crown, more rounded than black oak; gray pine has a lighter signature than ponderosa pine.

## 1029 - Canyon Live Oak/Greenleaf Manzanita Forest Association (Zone 2)

***Quercus chrysolepis/Arctostaphylos patula* Forest Association**

Taxa – Canyon live oak with moderately open canopy and sparse to dense greenleaf manzanita. Other montane chaparral species may be present. Conifers will occur in the general vicinity.
Microclimate – Submesic
Elevation – As low as 4500-5000 feet, upper Zone 2 to lowermost Zone 3
Soil – Well developed
Aspect – Southerly
Shape – Convex to neutral
Slope Position– Mid to upper
Steepness – Moderate to steep
Geology – n/a
Hydrology – Upland
Fire – Occurs within 15 years post burn in hot burns that removed conifer cover.
Frequency – Uncommon to rare – Canyon live oak and greenleaf manzanita generally occur at different elevation ranges with minimal overlap.



**1029 = Canyon Live Oak / Greenleaf Manzanita Forest Association**

Dense canyon live oak (bright red signature) with some greenleaf manzanita (orange signature) co-occurring for the most part in the sparser portions of the stand.

Note, the following similar map units can be confused with this type:

- Canyon Live Oak/Whiteleaf Manzanita Forest Association (1022) – is lower in elevation, less mesic, with possibly less dense canyon live oak and manzanita.

Key Photo Signature Notes: A higher elevation type than 1022, the greenleaf manzanita is a somewhat darker orange than whiteleaf manzanita. Generally has a higher vegetation cover than type 1022.

## **1040 - Interior Live Oak Woodland Alliance** (Zone 1)

***Quercus wislizenii var. wislizenis* Woodland Alliance**

Note: Although still in classification as a place holder, aggregated to type 1530 in PIFinal field

## 1041 - Interior Live Oak-Blue Oak-Gray Pine/Brome-Wild Carrot Woodland Association (Zone 1)

***Quercus wislizenii var. wislizenis Quercus douglasii- Pinus sabiana/Bromus spp. -* Woodland Association**

Note: Aggregated to type 1520 in PIFinal field

Observed in small stands north of the Merced River, primarily above the town of El Portal, on moderate to steep slopes, usually with a visible herbaceous understory. Rocky areas can occur within stands.

Taxa – Fairly closed to open stands containing a minimum of 5% each of the following trees: interior live oak, gray pine, and blue oak. Interior live oak should be more dominant than blue oak. Understory can be visible and is usually a mix of non-native annual grasses and forbs.
Microclimate – Xeric to dry mesic
Elevation – Primarily in Zone 1
Soil – Slight to moderate soil development with rocky areas interspersed
Aspect – Primarily southerly ranging from SE to SW
Shape - Convex
Slope Position – Mid to upper slopes
Steepness – Moderately steep to steep
Geology – n/a
Hydrology – Upland
Frequency – Uncommon, sites as a rule fairly small.

Note, the following similar map units can be confused with this type:

- Blue Oak–Interior Live Oak/Non-native Brome Grass-Wild Carrot Woodland Association (2034) - may be difficult to delineate where stands of gray pine are below 10%.
- Blue Oak-Gray Pine/Grass Woodland Association (2031) – has a slightly more open canopy, with more grassland understory on less steep slopes and deeper soils.

**1041 = Interior Live Oak – Blue Oak – Gray Pine / Brome - Wild Carrot Woodland Association**

In this example, gray pine (scattered throughout) is the most common co-dominant with lesser amounts of interior live oak and about a 5% relative cover of blue oak. Understory is predominantly herbaceous.

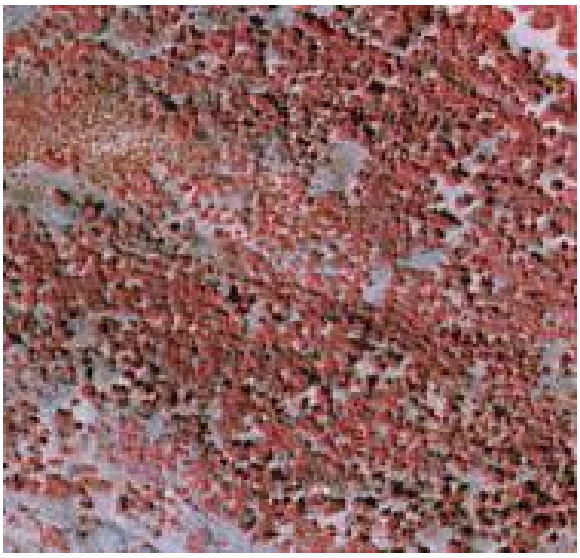
Key Photo Signature Notes: In nearly all stands where blue oak is present, there is a fairly well developed understory of annuals and grasses. Blue oak crown is somewhat more open than interior live oak yielding a signature more towards the orange and browns.

## 1042 - Interior Live Oak/Whiteleaf Manzanita Woodland Association (Zone 1)
***Quercus wislizenii var. wislizenis/ Arctostaphylos viscida* Woodland Association**

Note: Aggregated to type 1530 in PIFinal field

Noted in extremely xeric expressions on steep mid slopes primarily on southerly facing slopes above the Merced River west of the town of El Portal.

Taxa – Interior live oak and whiteleaf manzanita in open to sparse stands with a minimum of 1-5% of each species.
Microclimate – Extremely xeric
Elevation – Mainly upper portions of Zone 1
Soil – Minimal development
Aspect – Southerly to southwest
Shape – Convex
Slope Position – Mid to upper slopes
Steepness - Steep
Geology – n/a
Hydrology – Upland
Frequency – Uncommon



**1042 – Interior Live Oak / Whiteleaf Manzanita Woodland Association**

In this setting, interior live oak is in a moderately sparse setting with a dense understory of whiteleaf manzanita. Stands are often sparser than above example.

Note, the following similar map units can be confused with this type:

- Canyon Live Oak/Whiteleaf Manzanita Forest Association (1022) – Xeric expressions of 1022 where canyon live oak is shorter than usual due to fire history. Possibly separable based on elevation and aspect.

Key Photo Signature Notes: In most settings, interior live oaks are fairly small, herbaceous understory is generally minimal yielding little or no IR.

## 1043 - Interior Live Oak-Canyon Live Oak Woodland Association (Zone 1)
***Quercus wislizenii var. wislizeni-Quercus chrysolepis* Woodland Association**

Seen in the more significant ravines north of the Merced River where canyon live oak will tend to favor the lower moister portions of canyons and draws.

Taxa – Generally closed to nearly closed stands (>75%cover) of canyon live oak and interior live oak with a minimum of 25% of either species.
Microclimate – Dry mesic
Elevation – Mainly the upper portions of Zone 1 ranging from 1750 to 3000 feet
Soil – Minimal soil development associated with significant drainages.
Aspect – Primarily southerly, except at its lower elevation limits where it can occur on drier north facing aspects.

**1043 – Interior Live Oak – Canyon Live Oak Woodland Association**

Note in this image, canyon live oak yields a slightly brighter signature than adjacent interior live oak found upslope above the canyon bottom.

Shape - Concave
Slope Position – Lower to mid slope
Steepness – Moderately steep to steep
Geology – n/a
Hydrology – Usually associated with the drier fringes of riparian zones.
Fire – Infrequent
Frequency – Uncommon, as fairly narrow and linear mapping units.

Note, the following similar map units can be confused with this type:

- Canyon Live Oak–California Bay Forest Association (1024) - occurs in more mesic situations through most of Zone 2. Not restricted to riparian zones.

Key Photo Signature Notes: In ideal conditions, canyon live oak yields somewhat more IR signature (towards the reds and pinks) and has a slightly larger crown.

## 1500 – 1900 - Superalliances and Alliance-level Mapping Units

### 1510 - Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit (Zones 1 & 2)

***Quercus chrysolepis/Aesculus californica* Woodland *& Quercus wislizenii var. wislizeni – Aesculus californica* Shrubland Mapping Unit**

Associations: Interior Live Oak-California Buckeye Shrubland Association

Mapped in areas above 2000-2500 feet where associated oaks are in tree form. Environment is similar to lower elevation interior live oak-California buckeye association.

Taxa – Moderately open stands (>15% cover) of live oak (>10%) and California buckeye (>5%). Other shrub species and annual understory may be visible.
Microclimate – Xeric
Elevation – All of Zone 1
Soil – Poorly developed and rocky
Aspect – Variable but not northerly
Shape – Variable
Slope Position – Mid and upper slopes
Steepness - Steep to extremely steep
Geology – n/a
Hydrology – Upland

Frequency – Common, stands usually not very extensive

Note, the following similar map units can be confused with this type:

- Interior Live Oak-California Buckeye Shrubland Association (5041) – Stands of California buckeye below 2000-2500 feet should be placed into this association.

Key Photo Signature Notes: California buckeye (in leaf off conditions – early season loss) yield a very unique yellow signature. Crowns are medium to small and irregularly shaped.

**1510 – Canyon Live Oak / California Buckeye & Interior Live Oak – California Buckeye Shrubland Mapping Unit**

This particular example depicts canyon live oak and California buckeye (yellow signature) irregularly distributed in a sparse setting over poorly developed rocky soil.

## 1520 – Blue Oak–(Interior Live Oak-Gray Pine/Buckbrush/Annual Grass) Woodland Mapping Unit (Zone 1)

***Quercus douglasii–(Quercus wislizenii var. wislizeni-Pinus sabiana/Ceanothus cuneatus*/Annual Grass) Woodland Mapping Unit**

Note: Aggregation type including original PI Codes 1041, 2031, 2033, 2034 and 2035

Taxa – Open stands of blue oak with or without interior live oak and gray pine. Understory may be predominantly herbaceous with a mix of annual grasses and native forbs or in steeper settings may contain a sparse understory of buckbrush. Settings that are more favorable generally will contain a denser canopy cover with interior live oak and gray pine.
Microclimate – Xeric
Elevation – All of Zone 1
Soil – Moderately well developed
Aspect – Variable but not northerly
Shape – Variable
Slope Position – Mid and upper slopes
Steepness - Steep to extremely steep
Geology – n/a
Hydrology – Upland
Frequency – Common, stands usually not very extensive

Note, the following similar map units can be confused with this type:

- Interior live oak types in grassy settings containing no blue oak.

Key Photo Signature Notes: Difficult to ascertain presence of blue oak when cover is low; in this setting, it is difficult to distinguish from adjacent stands of a pure but sparse cover of interior live oak.

## 1530 – Interior Live Oak Woodland & Shrubland Superalliance (Zone 1)

***Quercus wislizenii var. wislizeni* Woodland and Shrubland Superalliance**

Note: Aggregation type including original PI Codes 1040, 1042 & 5040

Taxa – Open to closed stands of shrubby or arborescent interior live oak as sole or dominant to the canopy. In shrubby settings, other chaparral species typical of northerly trending slopes may be a component to the shrub layer. Drier settings may contain an associate of whiteleaf manzanita.
Microclimate – Variable
Elevation – Zone 1
Aspect – In shrubby settings, trending is variable but often northerly; woodland settings tend to face southerly
Shape – Variable
Slope Position – Mid to upper
Steepness – Moderate to steep
Hydrology – Upland
Frequency – An uncommon mapping aggregation of low elevation chaparral and woodlands.

Note, the following similar map units can be confused with this type:

- Type 5580 is found in more mesic chaparral settings and contains a broader mix of northern chaparral including chaparral ash, California buckeye with shrubby interior live oak

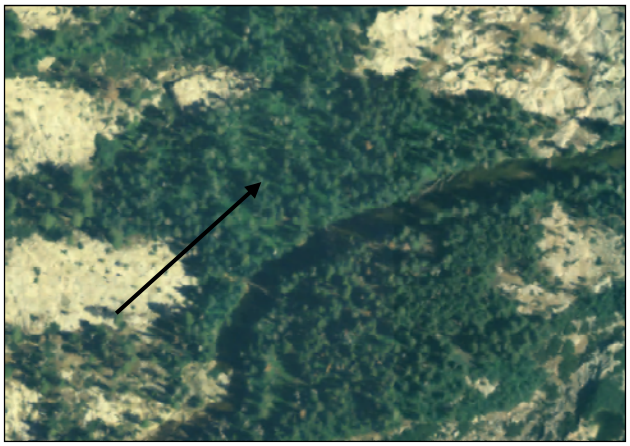
Key Photo Signature Notes: Not as variable a signature as type 5580; interior live oak generally yields a higher amount of CIR and therefore has a more reddish signature.

# 2000 - Broadleaf Deciduous Trees

## 2010 - Quaking Aspen Forest Alliance (Zones 4, 7, & 8)
***Populus tremuloides* Forest Alliance**

Note: Aggregation type including original PI Codes 2012 & 2017

## 2011 - Quaking Aspen/California False Hellebore Forest Association (Zones 4 & 7) [Potter]
***Populus tremuloides/Veratrum californicum* Forest Association**



Small examples were noted where California corn lily was observed on several meadows (Aspen Valley) all of which were below MMU. Stands in Zone 4, which deviate from the modal expression, such as non-extensive mesic stands of quaking aspen containing willow or bitter cherry, are mapped at the alliance level.

(Zone 4)
Taxa: Partial listing below, see Potter (1998) for complete species listing. (Potter sample size = 16). Tree cover is 49-96%, averaging 78%. Note this area has a high forb and grass cover (0-95%), average of 54%. See example just NE of Harden Lake north of White Wolf.

| | Cons | Cover |
|---|---|---|
| Tree Overstory | | |
| Quaking aspen | 94 | 36 |
| California red fir | 81 | 28 |
| White fir | 69 | 18 |
| Sierra lodgepole pine | 38 | 16 |
| Tree Understory | | |
| Quaking aspen | 100 | 4 |
| White fir | 62 | 3 |
| California red fir | 56 | 2 |
| Sierra lodgepole pine | 31 | 1 |
| Shrubs | | |
| Sierra gooseberry | 44 | 5 |
| Creeping snowberry | 31 | 15 |
| Forbs | | |
| Mountain sweet cicely | 75 | 4 |
| Fendler's meadow rue | 56 | 2 |
| Arrowleaf ragwort | 50 | 4 |
| California false hellebore | 50 | 6 |

Microclimate – Mesic
Elevation – 6500-8600 feet

Soil – 27-40”
Aspect – All
Shape – Concave to neutral
Slope Position - Lower slope, generally in drainage bottoms, but also middle slopes, toe slopes, and benches
Steepness – 2-31%, average = 12%; usually less than 15%; often less than 10%
Hydrology – Temporarily to seasonally flooded
Fire – More extensive with periodic fire
Frequency – Not seen in units above MMU on the Zone 3 & 4 reconnaissance

Note, the following similar map units can be confused with this type:
Quaking Aspen/Mountain Pennyroyal Forest Association (2012) – is drier.

(Zone 7)
During the field reconnaissance seen primarily in riparian settings in the upper portions of Lee Vining Creek. Note: Mapped sparingly, generally on the west side in wet environments.

Taxa – Dense stands of quaking aspen in riparian or meadow settings with at least 10% absolute cover of aspen.
Microclimate – Mesic
Elevation – Middle portions of Zone 7
Soil – 27-40”
Aspect – All
Shape – Concave to neutral
Slope Position – Lower slopes, generally in drainage bottoms, but also toe slopes, and benches
Steepness – 2-31%; average = 12%; usually less than 15%; often less than 10%
Hydrology – Temporarily flooded in places; temporarily to seasonally saturated in others
Fire – More extensive with periodic fire
Frequency – Rare

Note, the following similar map units can be confused with this type:

- This type and other conifer-aspen expressions are restricted in size and occur in close proximity to each other in riparian zones. Complexing is common with many areas falling below the MMU.
- Sierra Lodgepole Pine-Quaking Aspen-Jeffrey Pine Riparian Mapping Unit (3011) – is generally limited just to riparian settings on the east side.
- Type 2017 (Quaking Aspen/Meadow Mapping Unit) is inseparable from this association, but is mapped on the east side in lower elevations.
- Type 3012 (Sierra Lodgepole Pine-Quaking Aspen/Meadow Mapping Unit has the Sierra lodgepole pine conifer component and is mapped on the east side.

Key Photo Signature Notes: Generally tree structured quaking aspens in meadow environments occurring on both sides of the crest but mapped on the west side in wet environments.

## 2012 - Quaking Aspen/Mountain Monardella Forest Association (Zone 4)

***Populus tremuloides/ Monardella odoratissima* Forest Association**

Note: Aggregated to type 2010 (Alliance Level) in PIFinal field

Not identified on the Zone 3 and 4 photointerpretation reconnaissance; see Potter (1998). This type also has a high herbaceous component, but is found in middle and lower slopes, not drainage bottoms. Occasionally found on benches and upper slopes. May not be separable from type 2011, but may have lower IR for understory than 2011 because of drier conditions. Red fir is a more common component than white fir.

Taxa: Partial listing below; see Potter (1998) for listing of characteristic species. (Potter sample size = 19). Tree cover is 33-85%, averaging 71%. Note this area has a high forb and grass cover (0-90%), average of 93%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Quaking aspen | 100 | 48 |
| California red fir | 63 | 21 |
| Western juniper | 42 | 9 |
| Sierra lodgepole pine | 37 | 8 |
| Jeffrey pine | 32 | 2 |
| Tree Understory | | |
| Quaking aspen | 95 | 4 |
| California red fir | 63 | 2 |
| Western juniper | 42 | 1 |
| Sierra lodgepole pine | 32 | 1 |
| Shrubs | | |
| Creeping snowberry | 29 | 4 |
| Big sagebrush | 32 | 4 |
| Wax currant | 26 | 1 |
| Forbs | | |
| Wright's blue eyed mary | 58 | 14 |
| Mountain tansy mustard | 58 | 2 |
| Mountain pennyroyal | 58 | 5 |
| Mountain sweet cicely | 58 | 6 |
| Fendler's meadow rue | 58 | 11 |

Microclimate –
Elevation – Upper portion of Zone 3 to middle of Zone 4, 6920-9100 feet, average 8046 feet
Soil – 30-40"
Aspect – SE, SW, NW, solar radiation levels moderate to high
Shape – Neutral to concave
Slope Position - Middle and lower slopes, sometimes in bottoms adjacent to meadows, or on benches; and upper slopes, generally more frequent in upland settings
Steepness – 3-33%, average 18%, gentle
Hydrology – Temporarily saturated to upland
Fire – More extensive with periodic fire

Frequency – Never large or extensive, usually less than 5 acres

Note, the following similar map units can be confused with this type:

- Quaking Aspen/California Corn Lily Forest Association (2011) – is more mesic.

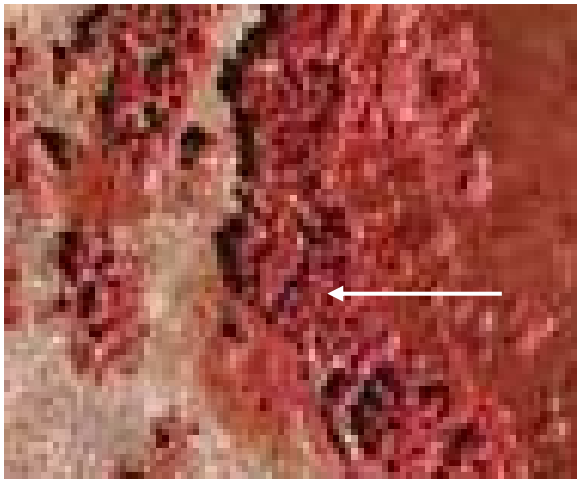
Key Photo Signature Notes: Mapped in drier settings sparingly on the west side, quaking aspen takes on a small tree or shrub form in most examples

## 2013 - Quaking Aspen/Willow spp. Forest Mapping Unit (Zones 7 & 8)

***Populus tremuloides/Salix* spp. Forest Mapping Unit**

Associations: Quaking Aspen/Woods Rose Forest Association

During the field reconnaissance primarily observed in the upper portions of Zone 8 and most of Zone 7 as fairly narrow units, quite often either above or below small meadows.



**2013 – Quaking Aspen/Willow spp. Forest Mapping Unit**

In this example, the lighter Willow with the rounded crown is more common in the right portion of the image adjacent to the meadow.

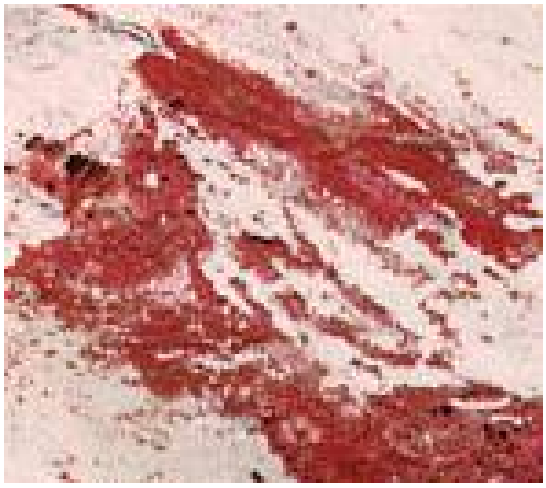
Taxa – Emergent stands of quaking aspen of at least 30% cover over dense but local patches of willow (*Salix* spp.) of at least 30% cover.
Elevation – Most of Zone 7 and upper portion of Zone 8
Aspect – All
Shape - Concave
Slope Position – Lower
Steepness – Level to slight slope
Hydrology – Temporarily to seasonally flooded
Fire – More extensive with periodic fire
Frequency – Fairly common, but mapping units are usually fairly small
Note, the following similar map units can be confused with this type:

- Quaking Aspen/Shrub Willow spp. High Elevation Talus Mapping Unit (2014) – occurs on talus slopes in rocky environments.
- Quaking Aspen/Meadow Mapping Unit (2017) – occurs in meadows but has no willow.
- Sierra Lodgepole Pine– Quaking Aspen types generally occur at higher elevations and have a darker conifer (lodgepole) component.

Key Photo Signature Notes: Generally found in riparian to meadow-riparian settings where the lighter signature willow co-dominates with the darker signature (more towards magentas and reds)

## 2014 - Quaking Aspen/Willow spp. Talus Mapping Unit (Zone 7)

***Populus tremuloides/Salix* spp. Talus Mapping Unit**



**2014 – Quaking Aspen/Willow spp. Talus Mapping Unit**

Mapped in steep talus settings where both aspen and willow co-occur, this example depicts a dominance of quaking aspen with the brighter Willow signature occupying the wetter sites adjacent to the rivulets.

During the field reconnaissance observed, in most of the major east-west trending canyons, as narrow bands running up the sideslopes, often occurring repeatedly over short distances. Bare rock talus often surrounds these narrow mapping units.

Taxa – Sparse to moderately dense stands of shrubby quaking aspen of at least 5% cover, distributed evenly or irregularly with shrubby willow species of at least 5% cover.
Microclimate -
Elevation – >9000’
Soil – Little to no soil development
Aspect – As a rule, northerly; however also southerly at highest elevations
Shape – Variable, but usually convex (on talus)
Slope Position – Usually lower to mid
Steepness – Steep to extremely steep
Geology – Talus
Hydrology – Temporarily to seasonally flooded or saturated
Fire/Disturbance – May be associated with avalanche chutes, only moderately stable talus
Frequency – Fairly common but restricted
Note, the following similar map units can be confused with this type:

- Quaking Aspen/Shrub Willow spp. Riparian Mapping Unit (2013) – occurs in riparian and meadow-riparian situations.
- Quaking Aspen/Meadow Mapping Unit (2017) – occurs in meadows.
- Shrub Willow-Steep Talus Setting Mapping Units (6506, 6512) - lack the presence of quaking aspen and generally occurs in somewhat wetter environments.

## 2015 - Quaking Aspen-Jeffrey Pine/(Big Sagebrush) Forest Association (Zone 8)

***Populus tremuloides- Pinus jeffreyi/(Artemesia tridentata)* Forest Association**

**2015 – Quaking Aspen – Jeffrey Pine / (Big Sagebrush) Forest Association**

Generally a riparian community, downstream from type 3011; Jeffrey pine shows up as the rounded crown conifer more concentrated on the left side of the image, quaking aspen (a brighter signature) on the right side.

Observed during the field reconnaissance above riparian settings and on dry mesic hillsides in most major drainages along the east side.

Taxa – Jeffrey pine and aspen in sparse to moderately dense stands of at least 10% cover over a sparse to moderately dense understory layer of big sagebrush of at least 10% cover. Mesic edges may contain meadow rushes especially Baltic rush.
Microclimate -
Elevation – Upper portions of Zone 8 and lower portions of Zone 7
Shape – Usually convex
Slope Position – Lower slope
Steepness – Slight to moderate
Hydrology – Riparian or upland
Fire – Infrequent
Frequency – Fairly common, often transitional to wetter meadows

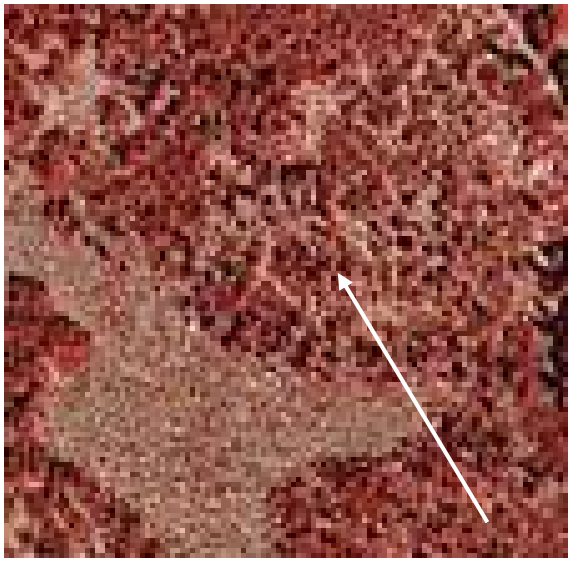
Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Meadow Edge Mapping Unit (3047) - is usually closer to meadows, and may be adjacent to 2015.
- Sierra Lodgepole Pine- Quaking Aspen Meadow Mapping Unit (3012) – is usually closer to meadows, and may be adjacent to 2015.

Key Photo Signature Notes: Note varying size and color of both conifer species along with the brighter IR signatures found in quaking aspen.

## 2016 - Quaking Aspen/Big Sagebrush Forest Superassociation (Zone 8)

***Populus tremuloides/Artemesia tridentata* Forest Superassociation**



**2016 – Quaking Aspen/Big Sagebrush Forest Superassociation)**

Depicted in this example with aspen taking on a shrubby form; aspen may form a fairly dense tree canopy in this dry aspen type.

Associations: Quaking Aspen/Big Sagebrush Forest Association, Quaking Aspen/Big Sagebrush-Mountain Pennyroyal/Kelloggia Forest Association, Quaking Aspen Forest Alliance (dry types)

The most xeric expression of the quaking aspen types, usually found up slope from quaking aspen in riparian or meadow situations, often in association with some seepage. Quaking aspen usually take on a scrubby form in this type.

Taxa – Sparse to nearly closed stands of quaking aspen of at least 5% cover over a sparse to moderately dense stand of big sagebrush of at least 5% cover. Drier edge herbaceous species, including Baltic rush, bluegrass (*Poa* spp.) and Douglas sedge (*Carex douglasii*), often occur in the understory layer.
Microclimate – Mesic
Elevation – Generally the upper portions of Zone 8
Aspect – Variable
Shape – Variable
Slope Position – Flats and lower slopes
Steepness – Moderate to shallow
Hydrology – Temporarily saturated (?)
Fire – Limited in extent in absence of fire
Frequency – Fairly common, usually small units
Note, the following similar map units can be confused with this type:

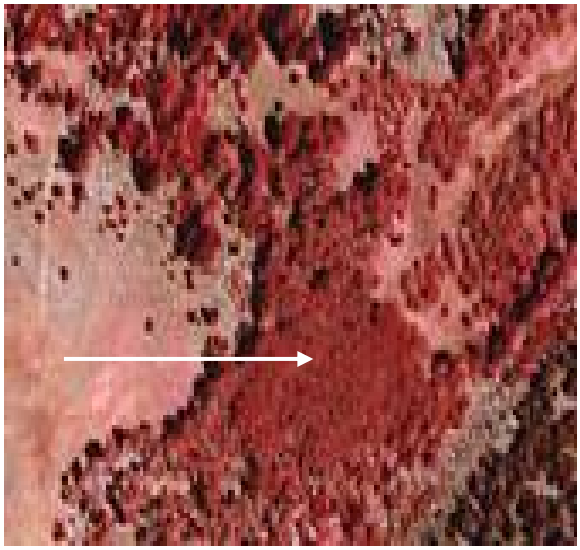
- Quaking Aspen/Meadow Mapping Unit (2017) – drier portions may be difficult to differentiate from 2016 in nearly closed stand settings.

Key Photo Signature Notes: Quaking aspen in this setting yields a somewhat less bright signature (tending towards dark brown) than most aspen types.

## 2017 - Quaking Aspen/Meadow Mapping Unit (Zones 7 & 8)
***Populus tremuloides*/Meadow Mapping Unit**

Note: Aggregated to type 2010 (Alliance Level) in PIFinal field

Extensive stands of this type were noted just north of Conway summit in the Virginia Creek drainage, and also above Summers Meadows near the Green Creek road.



**2017 – Quaking Aspen/Meadow Mapping Unit**

Mapped in eastside quaking aspen-meadow environments in varying stand structure and density. Note variable species composition in the meadow understory in this example.

Taxa – Sparse to dense stands of at least 5% cover of quaking aspen over a dense herbaceous layer of rushes (*Juncus* spp.), bluegrass (*Poa* spp.), sedge (*Carex* spp.), and wild rye (*Elymus* spp.).
Microclimate – Mesic
Elevation – Generally below 10,000 feet, Zone 7 & 8
Steepness – Flat to moderate
Hydrology – Temporarily flooded
Frequency – Fairly common, often as very large stands
Note, the following similar map units can be confused with this type:

- Quaking Aspen/Big Sagebrush Mapping Unit (Superassociation) (2016) – more mesic stands grade into 2017.
- Sierra Lodgepole Pine–Quaking Aspen types contain a conifer component that yields a darker IR signature.
- Quaking Aspen/Shrub Willow spp. Riparian Mapping Unit (2013) - has a willow component

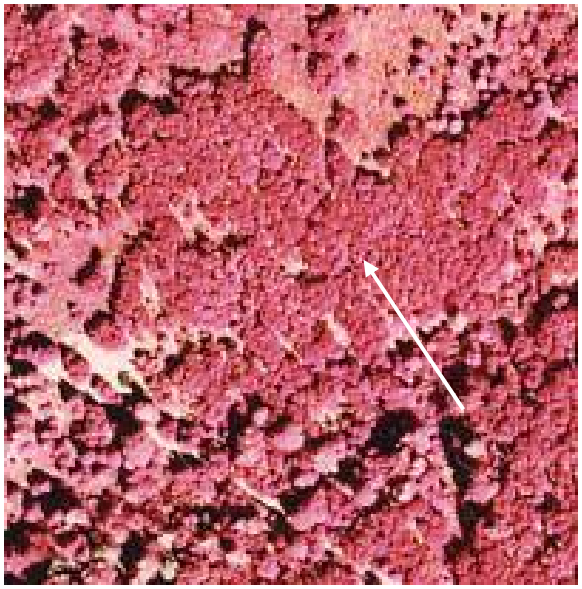
Key Photo Signature Notes: Note single woody species dominance (quaking aspen) over a variable meadow environment; usually temporarily flooded.

## 2020 - California Black Oak Forest Alliance (Zones 2 & 3)
***Quercus kelloggii* Forest Alliance**

Associations: California Black Oak/Mewuk Manzanita-Mountain Misery Forest Association

Used as a “catch all” for more or less pure stands of California black oak in moderately open to closed situations with several environmental expressions. Also observed as pure stands in closed canopy forest associations, often in late seral post fire environments.

Taxa – California black oak in moderately open to closed canopy environments.



**2020 – California Black Oak Forest Alliance**

Mapped in a wide range of stand structure, this example is dense California black oak, with conifer starting to mix in the lower portion of the photo and shrubs in the upper portion.

Microclimate – Submesic to fairly dry. Dry mesic in closed forest types.
Elevation – Uppermost portions of Zone 1 through lower portions of Zone 3
Soil – Well developed; also well drained in forest environments
Aspect – Variable depending on elevation more northerly at its lower elevation expressions, and south to southwest toward the upper limits of Zone 2
Shape – Generally slightly convex
Slope Position – Lower to mid slopes
Steepness - Moderate
Hydrology – Upland
Fire – Common with fire history of approximately 30 years
Frequency – Fairly common but not extensive
Note, the following similar map units can be confused with this type:

- California Black Oak-Incense-cedar Forest Association (2022) - in closed canopy forest situations, will have incense-cedar >25% cover. California black oak is more common with fire history. California black oak-incense-cedar forest association will have more incense-cedar due to fire suppression, and is probably a rare type.
- Valley Oak Woodland Alliance (2040) – looks similar to 2020 in meadow environments, however, California black oak crowns are usually narrower and less well defined. Valley oaks will for the most part occur at lower elevations.
- Canyon live oak types generally yield an IR signature a bit towards the light pinks and have a somewhat more rounded and less diffuse crown.

Key Photo Signature Notes: California black oak signature although variable, is nearly always a brighter red than canyon live oak.

## 2021 - California Black Oak/Greenleaf Manzanita Forest Association (Zone 2)

***Quercus kelloggii/Arctostaphylos patula* Forest Association**

Taxa – California black oak of moderately open canopy with open to closed canopy of greenleaf manzanita. Other montane chaparral shrub species may be present (bush chinquapin, whitethorn ceanothus).

Microclimate – Fairly dry
Elevation – Over 5500 feet, Zone 2
Soil – Moderately well developed
Aspect - All
Shape – Convex
Slope Position – Mid to upper slopes
Steepness – Moderate to steep
Geology – n/a
Hydrology – Upland
Fire – No evidence of fire in sites surveyed
Frequency – Rare

Note, the following similar map units can be confused with this type:

- Canyon Live Oak/Greenleaf Manzanita Forest Association (1029) - occurs in steeper, rockier settings

**2021 – California Black Oak / Greenleaf Manzanita Forest Association**

This example contains a minor conifer component towards the edges of the scene; most mapped stands are small openings in conifer forests such as this one.

## 2022 - California Black Oak-Incense-cedar Forest Association (Zone 2)

***Quercus kelloggii – Calocedrus decurrens* Forest Association**

Although this type does not appear to be common or occupy extensive areas, it was occasionally observed in a several settings within Zone 2. Noted in the Yosemite Valley south of the Merced River and the Bishop Creek RNA. Note: could occur on sites that have seen die-offs of ponderosa pine due to bark beetle infestations in pines.

Taxa – Dominant California black oak with a minimum of 10-20% incense-cedar in closed to fairly open settings.
Microclimate – Dry mesic to mesic
Elevation – Most portions of Zone 2
Soil – Moderately developed in places, fairly rocky in others.
Aspect – Variable
Shape – Variable
Slope Position – Usually mid slopes
Steepness – Minimal to moderately steep
Geology – Noted in association with glacial and till rocky areas.
Hydrology – Upland

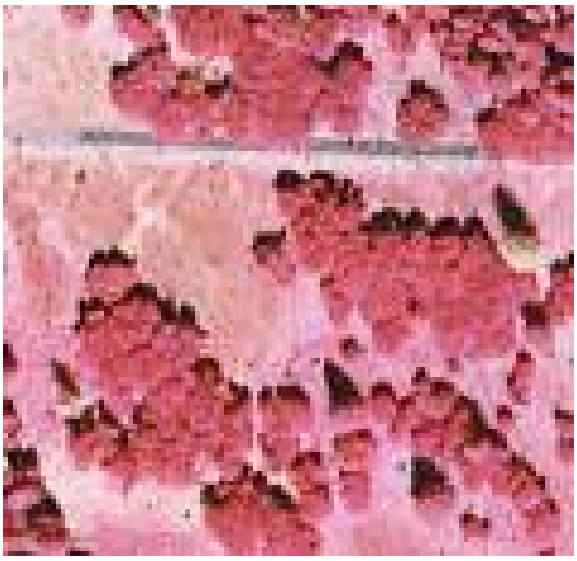
Fire – Less common with recent fire history
Frequency – Rare to uncommon, generally as a fairly small mapping unit. Environmental expressions however do vary more extensively than most types.

Note, the following similar map units can be confused with this type:
California Black Oak Forest Alliance (2020) – in closed canopy situations will have incense-cedar of <10-20% cover. California black oak-incense-cedar forest association will have more incense-cedar due to fire suppression.

- Ponderosa Pine-Incense-cedar/Mountain Misery Forest Association (3063) - Generally not separable from this type, not enough examples to extrapolate a reliable photo signature.

## 2025 - California Black Oak/(Bracken Fern) Forest Mapping Unit (Zone 2)

***Quercus kelloggii/(Pteridium aquilinum*) Forest Mapping Unit**



**2025 – California Black Oak/(Bracken Fern) Forest Mapping Unit**

This example taken in the Yosemite Valley shows a number of different herbaceous understories to the California black oak canopy.

Taxa – Tall open canopy of California black oak adjacent to meadows with high cover (>60%) of bracken fern or other forbs in the understory.
Microclimate – Mesic to possibly temporarily saturated in meadow edge environments
Elevation – Most of Zone 2
Soil – Well developed
Aspect – Neutral
Shape – Flat
Slope Position – Valley bottom
Steepness – Level
Geology – n/a
Hydrology – Adjacent to meadow
Fire – Rare
Frequency – Rare

Note, the following similar map units can be confused with this type:

- None

Key Photo Signature Notes: California black oaks are often quite large over a meadow environment yielding a high degree of brightness in the IR.

## 2030 - Blue Oak Woodland Alliance (Zone 1)

***Quercus douglasii* Woodland Alliance**

### 2031 - Blue Oak-Gray Pine/Grass Woodland Association (Zone 1)

***Quercus douglasii- Pinus sabiniana* /Grass Woodland Association**

Note: Aggregated to type 1520 in PIFinal field

**2031 = Blue Oak – Gray Pine / Grass Woodland Association**

In this example, blue oak dominates the stand with a significant component of gray pine. A minor amount of interior live oak can be seen in the upper right portion of the photo.

Several small stands were noted on steep slopes in close association with the interior live oak–blue oak–gray pine/brome-wild carrot woodland association below the Arch Rock park entrance on slopes above the Merced River. Also seen in small areas north of the Drew Meadow on the Cherry Valley road.

Taxa – Moderately open stands of blue oak with emergent gray pine of at least 1-5% with an understory of California Annual Grasses (possibly with a native component) and herbs.
Microclimate – Dry mesic
Elevation – Primarily Zone 1, below 3000 feet
Soil – Moderately well developed
Aspect – Southerly, but not extreme (rarely SW)
Shape – Convex
Slope Position – Mid to upper slopes
Steepness - Moderately steep to steep
Geology – n/a
Hydrology – Upland
Frequency – Uncommon
Note, the following similar map units can be confused with this type:

- Interior Live Oak–Blue Oak–Gray Pine/brome-Wild Carrot Woodland Association (1041) - appears to be a slightly more closed canopy type with less of a grassland understory on steeper and shallower soils.

Key Photo Signature Notes: Generally found over a herbaceous understory; note uniform signature of one species of oak.

### 2033 - Blue Oak/Non-native Brome Grass-Wild Carrot Woodland Association (Zone 1)

***Quercus douglasii/* Non-native Brome Grass-*Daucus carota* Woodland Association**

Note: Aggregated to type 1520 in PIFinal field

**2033 = Blue Oak/Non-native Brome Grass-Wild Carrot Woodland Association**

Blue oak is rare in pure stands in the study area; more often occurring with interior live oak. in this example, blue oak represents about 90% of the relative tree cover over a herbaceous understory.

Observed in small units below El Portal and along the Cherry Valley road near Drew Meadow. A sizable stand occurs just north of the Yosemite Research Center. Individual trees vary greatly in size depending on environmental factors such as proximity to the riparian corridor and the severity of the slope.

Taxa – Open to fairly open stands of at least 1-5% blue oak with primarily a non native annual grassland understory (California Annual Grassland)
Microclimate – Xeric to dry mesic
Elevation – Most of Zone 1, more common at the lower portions below 2000 feet
Soil – Moderately well developed
Aspect – Generally southerly
Shape – Convex
Slope Position – Mid to upper slopes
Steepness – Moderately to extremely steep
Geology – n/a
Hydrology – Upland
Frequency - Uncommon; stands not extensive in environs

Note, the following similar map units can be confused with this type:

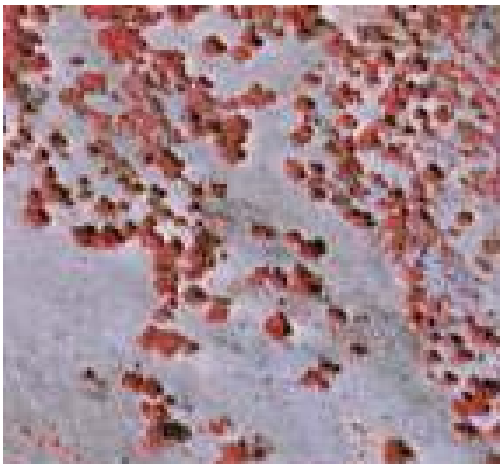
- Other blue oak associations are similar but contain higher variability in overall PI signature reflected by the other tree species. This is probably the most open type within the blue oak woodland alliance.
- Blue Oak-Interior Live Oak/Non-native Brome Grass-Wild Carrot Woodland Association (2034) – has a more closed canopy.

Key Photo Signature Notes: Uniform signature of the blue oak (diffuse open crown trending towards the orange and browns) always over a herbaceous understory.

## 2034 - Blue Oak-Interior Live Oak/Non-native Brome Grass-Wild Carrot Woodland Association (Zone 1)

***Quercus douglasii-Quercus wislizenii var. wislizeni/* Non-native Brome Grass-*Daucus carota* Woodland Association**

Note: Aggregated to type 1520 in PIFinal field



**2034 – Blue Oak – Interior Live Oak / Non-native Brome Grass-Wild Carrot Woodland Association**

Image represents a typical stand containing a minor component of gray pine also. Note total lack of IR signature on the summer-dry grass understory.

Observed on the mid slopes along Foresta Road just above El Portal. Stands were for the most part extremely small, but mappable.

Taxa – Fairly open stands of blue oak and interior live oak, with a minimum of 1-5% cover for each species. Herbaceous understory of non-native annual grasses between stands can be broken up by minor rocky areas.
Microclimate – Extremely xeric
Elevation – Zone 1
Soil – Moderately well developed
Aspect - Southerly
Shape – Convex
Slope Position – Mid slopes
Steepness - Extremely steep
Geology – n/a
Hydrology – Upland
Frequency – More common than blue oak/non-native brome grass-wild carrot woodland association.

Note, the following similar map units can be confused with this type:

- Interior Live Oak–Blue Oak–Gray Pine/Brome-Wild Carrot Woodland Association (1041) - is more closed and contains sparse emergent gray pine.
- Blue Oak/Non-native Brome Grass-Wild Carrot Woodland Association (2033) - usually contains a more open canopy.

Key Photo Signature Notes: Generally open stands with annuals and grasses; blue oak has a more diffuse and open crown trending slightly towards oranges and browns in the IR. Interior

live oak crown tends to yield IR signatures more in the pinks and lighter magentas and has a denser crown.

## 2035 - Blue Oak/Buckbrush/Annual Grass Woodland Association (Zone 1)

***Quercus douglasii/ - Ceanothus cuneatus* /Annual Grass Woodland Association**

Note: Aggregated to type 1520 in PIFinal field

Possibly seen along southerly slopes just north of the Merced River but this type was never substantiated. Buckbrush was observed in and near stands of blue oak in several instances.

Taxa – Open to fairly open stands of at least 1-5% blue oak with sparse (1-20%) buckbrush occupying the rocky areas. Both species are emergent to an annual grassland comprised primarily of non-native species.
Microclimate – Xeric
Elevation – Zone 1, especially the lower portions
Soil – Moderately well developed, but rocky in places
Aspect – Generally south to southwest
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Steep
Hydrology – Upland
Frequency – Uncommon

Note, the following similar map units can be confused with this type:

- Other associations within the blue oak woodland alliance do not contain shrub forms.
- Blue Oak–Interior Live Oak/Non-native Brome Grass-Wild Carrot Woodland Association (2034) - usually has a denser canopy cover and a more variable canopy signature from the species diversity in oaks.

## 2040 - Valley Oak Woodland Alliance (Zone 1)
***Quercus lobata* Woodland Alliance**

**2040 – Valley Oak Woodland Alliance**

This example is taken from an area of El Portal; examples within the study area are rare. This site also contains several black cottonwood individuals.

Generally found west of the environs; a couple of stands were noted along the broader terraces along the Merced River west El Portal. The largest stands are in association with land use disturbance within the town of El Portal. Two other sites were noted within one mile of the Yosemite Research Center. Most stands were noted with other canopy species such as California black oak and black cottonwood.

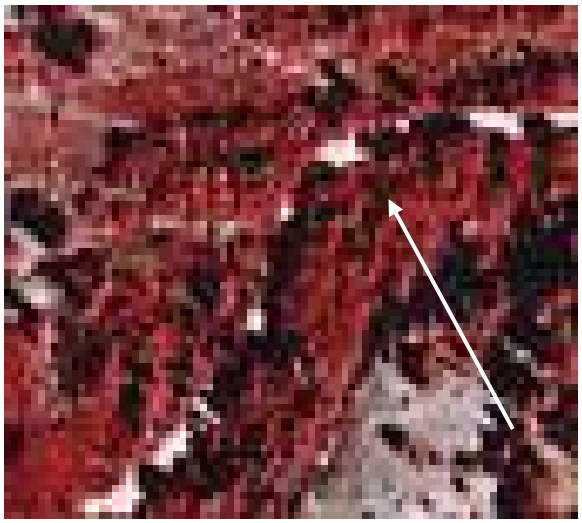
Taxa – Valley oak in fairly open stands normally between 10 and 25% with a herbaceous or disturbed understory.
Microclimate – Mesic
Elevation – Lower portions of Zone 1
Soil – Well developed
Aspect – Neutral
Shape – Flat
Slope Position – Valley bottom
Steepness - Minimal
Geology – Associated with river terrace
Hydrology – Upland (river terraces within environs)
Fire – n/a
Frequency – Rare
Note, the following similar map units can be confused with this type:

- California Black Oak Forest Alliance (2020) - in meadow environments looks similar, however, California black oak crowns are usually narrower and less well defined. Valley oaks will for the most part occur at lower elevations.

## 2050 - Black Cottonwood Temporarily Flooded Forest Alliance (Zones 2, 7, & 8)

***Populus balsamifera ssp. trichocarpa* Temporarily Flooded Forest Alliance**

Note: Aggregation type including original PI Code 2051



**2050 = Black Cottonwood Temporarily Flooded Forest Alliance**

Only small stands noted in the study area, this example (a band of riparian trees running along the south side of the road) is co-dominated with white fir.

Observed along the Merced River along sandbars and small islands, especially in the upper portions of Zone 1 and lower portions of Zone 2 in the Yosemite Valley. Many stands are well below 0.5 hectare and are too small to map. Stands were also noted in association with meadow environments within the Yosemite Valley.

Taxa – Black cottonwood in sparse to dense stands often with a sparse shrub or small tree layer of associated willow and other riparian shrub species.
Microclimate – Mesic
Elevation – Upper portions of Zone 1 and lower portions of Zone 2.
Soil – Cobbly, associated with active streambed; sandbars, and meadows.
Shape – Concave to neutral
Slope Position – Valley bottoms
Geology – Stream banks, bars and small islands.
Hydrology – Temporarily to seasonally flooded
Fire – Infrequent
Frequency – Uncommon

Note, the following similar map units can be confused with this type:

- White Alder Temporarily Flooded Forest Alliance (2060) - will usually occupy narrower and steeper channels.
- Willow Mapping Units (2510, 6500's) - in similar settings probably will yield a less textured signature.

## 2051 - Black Cottonwood/Western Azalea Forest Association (Zone 2)

***Populus balsamifera ssp. Trichocarpa/ Rhododendron occidentale* Forest Association**

Note: Aggregated to type 2050 (Alliance level) in PIFinal field

Taxa – Black cottonwood in sparse to dense stands (5-50% cover) sometimes with an emergent white alder component (up to 10-20%) with a sparse shrub layer of western azalea (1-5%) and willow (*Salix* sp.) and a rich herbaceous layer.
Microclimate –
Elevation – Zone 2
Soil – Well developed
Aspect – None

Shape – Neutral
Slope Position – Valley bottoms
Steepness – Gentle
Hydrology – Temporarily to semi-permanently flooded
Fire – Infrequent
Frequency – Infrequent

Note, the following similar map units can be confused with this type:

- White Alder Temporarily Flooded Forest Alliance (2060) – is on steeper gradient streams with higher cover of white alder.

Key Photo Signature Notes: No signature has been established for western azalea. May be necessary to map to alliance level.

## 2052 - Black Cottonwood–Quaking Aspen (Jeffrey Pine)/ Willow spp. Mapping Unit (Zones 7 & 8)

***Populus balsamifera ssp. Trichocarpa – Populus tremuloides (Pinus jeffreyi)/ Salix* spp. Mapping Unit**

During the field reconnaissance observed in the higher portions of Lee Vining Canyon as complex riparian mapping units, in most cases too small to map. One fairly large example was noted near the pumping station. Other narrow riparian examples were also noted along the edge of a portion of Upper Twin Lake and below Lundy Lake.

Taxa – Quaking aspen and black cottonwood in usually dense riparian settings of at least 5% cover of either species
Microclimate – Cold air drainages
Elevation – Lower portions of Zone 7
Aspect – Variable
Shape – Concave
Slope Position – Canyon bottoms
Steepness – Slight to moderate
Hydrology – Temporarily to seasonally flooded
Fire – Fire not an important process in this type
Frequency – Uncommon, and limited in size

Note, the following similar map units can be confused with this type:

- None.

Key Photo Signature Notes: Black cottonwood is extremely difficult to distinguish from quaking aspen in the environs mainly because stands are so infrequent and small. Generally, the cottonwood yields IR signatures a bit more towards the reds and has a slightly larger crown.

## 2060 - White Alder Temporarily Flooded Forest Alliance (Zones 2 & 3)

***Alnus rhombifolia* Temporarily Flooded Forest Alliance**

Note: Aggregated to type 2520 in PIFinal field

Associations: White Alder Forest Association

This type was not observed specifically during the field reconnaissance for Zones 1 and 2, however it will probably be possible to map based on physical parameters.

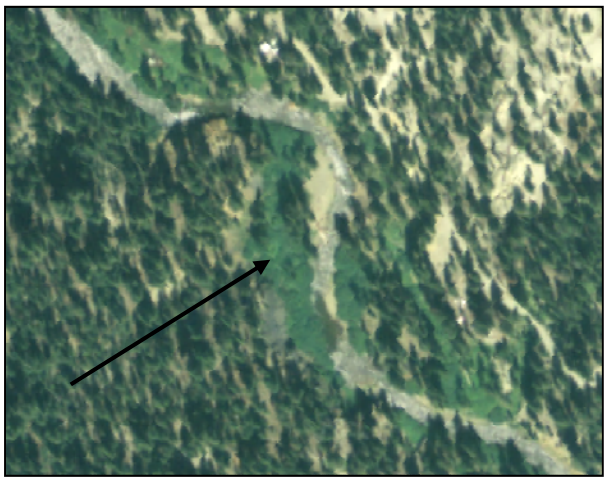
Taxa – White alder usually forming a nearly closed to closed canopy in narrow bands associated with perennial streams.
Microclimate – Mesic
Elevation – Upper portions of Zone 1 through the lower portions of Zone 3.
Soil – Associated with fairly narrow streamside, gravelly
Aspect – Variable
Shape – Concave
Slope Position – Drainage bottoms
Steepness - Minimal to moderately steep
Geology – Streamside alluvial
Hydrology – Seasonally to permanently flooded.
Fire – Not an important process in this type
Frequency – Unknown

Note, the following similar map units can be confused with this type:

- Bigleaf Maple Forest Alliance (2080) – is generally found in steeper and rockier environments such as canyon side slopes.
- Black Cottonwood Temporarily Flooded Forest Alliance (2050) - will be associated in general with much larger drainages and more naturally disturbed sites (sand bars and small islands).
- Douglas-fir-White Alder Forest Association (4014) – is found in narrower canyons and has a conifer component. Use associated conifer stands to aid in mapping.
- Incense-cedar-White Alder Forest Association (4111) – is found in narrower canyons and has a conifer component. Use associated conifer stands to aid in mapping.

Key Photo Signature Notes: White alders within the environs nearly always are in stands too narrow to map; occasionally bands of white alder are wide enough to delineate; their signature is similar to quaking aspen but their range is fairly exclusive of one another.

## 2070 - Mountain Alder Mapping Unit (Zone 4)
***Alnus incana* ssp. *tenuifolia* Mapping Unit**



Taxa – Mountain alder dominates the tall shrub or small tree canopy in dense but locally small stands, occasionally with willow or emergent black cottonwood.
Microclimate – Riparian
Elevation – Zone 4
Soil – Rocky
Aspect – Variable
Shape – Variable
Slope Position – Low
Steepness - Minimal
Geology – Alluvium
Hydrology – Temporarily to seasonally flooded
Frequency – Uncommon, local to San Joaquin River, stands usually not very extensive

Note, the following similar map units can be confused with this type:

- Tree willow (type 2510)
- Quaking aspen types
- Black cottonwood

Key Photo Signature Notes: Look for presence of riparian trees in small dense patches along the edges of the San Joaquin River. Most stands are downslope of Devils Postpile National Monument.

## 2080 - Bigleaf Maple Forest Alliance (Zone 2)

***Acer macrophyllum* Forest Alliance**

Note: Aggregated to type 2520 in PIFinal field

**2080 – Bigleaf Maple Forest Alliance**

This example depicts a steep northerly setting above Yosemite Valley. The bigleaf maple is in the linear riparian zone running south to north in the center of the picture.

Taxa – Bigleaf maple as a dominant; often co-occurring with alder, sometimes with a minor component of California bay or canyon live oak.
Microclimate – Mesic
Elevation – Zone 2
Aspect – Very steep and rocky
Shape – Concave
Slope Position – Probably lower slopes to valley bottoms and streamsides, even on steep slopes
Steepness – Often steep
Hydrology – Temporarily to seasonally flooded
Frequency – Infrequent

Note, the following similar map units can be confused with this type:

- White Alder Temporarily Flooded Forest Alliance (2060) – may be confused with 2080. White alder temporarily flooded forest alliance is not as steep or rocky.

Key Photo Signature Notes: Bigleaf maple stands within the environs are limited to near MMU stands, generally are seen with rocky steep streams and take on a somewhat lighter IR signature than white alder.

## 2500 - 2990 - Superalliances and Alliance-level Mapping Units

### 2510 - Willow Spp. Mapping Unit (Zones 1 & 2)
***Salix Spp.* Mapping Unit**

Noted in both Zones 1 and 2, however stands in Zone 1 were generally larger and could at times be above 0.5 hectare. Usually associated with lower energy streams, major rivers including the Merced and Tuolumne, and meadow environments. See mapping notes for willow alliances.

Taxa – Red willow (*Salix laevigata*) is the most common dominant in this tree willow mapping unit. Tree forms of arroyo willow (*Salix lasiolepis*) or shining willow (*Salix lucida*) may be present.

Elevation – Throughout Zones 1 and 2
Soil – Alluvial, sandy or silty.
Aspect – Variable
Shape – Concave to neutral
Slope Position – Drainage bottoms
Steepness – Usually minimal in Zones 1 and 2 except in extremely small stands along steep perennial streams or along major water courses.
Geology – Streamside alluvial
Hydrology – Seasonally to permanently flooded
Fire – Not an important or frequent process in this type
Frequency – Fairly common but restricted in size.

Note, the following similar map units can be confused with this type:

- Black Cottonwood Temporarily Flooded Forest Alliance (2050) - occupies similar environments, however the crown canopy is usually more irregular yielding more of a texture on the aerial photography. Black cottonwood normally occupies lower gradient streams.
- Bitter Cherry Shrubland Alliance (6300) – Bitter cherry generally occupies post burn environments but is difficult to distinguish from willow since they both often occupy riparian environments.

Key Photo Signature Notes: Willow signature is extremely variable depending on stand size, structure and species composition. In Zones 1 & 2, always associated with perennial streams.

### 2520 - White Alder & Bigleaf Maple Forest Superalliance (Zones 2 & 3)
***Alnus rhombifolia & Acer macrophyllum* Forest Superalliance**
Note: Aggregation type including original PI Codes 2060 & 2080

Taxa – White alder and or bigleaf maple dominate the canopy; usually steeper and rockier settings will contain maple. Conifers such as incense-cedar or Douglas-fir may be a minor component to the canopy.
Microclimate – Riparian
Elevation – Zone 1 & 2
Soil – Moderately well developed
Aspect – Variable
Shape – Variable
Slope Position – Low
Steepness - Moderate to extremely steep
Geology – n/a
Hydrology – Temporarily to seasonally flooded
Frequency – Uncommon, stands usually not very extensive

Note, the following similar map units can be confused with this type:

- Tree willow (type 2510)

Key Photo Signature Notes: Look for presence of riparian trees often as a narrow band within dense lower elevation mixed conifer forests. Brighter signature of the broadleaf trees is diagnostic.

# 3000 - Needleleaf Evergreen Pine Trees

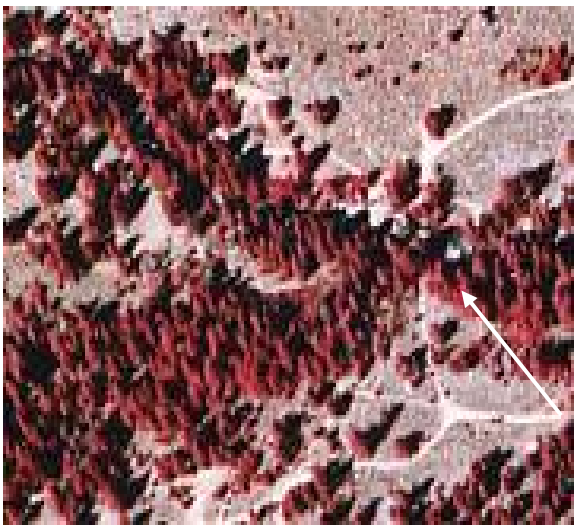
## 3010 - Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Mapping Unit (Zones 4 & 8)

***Pinus contorta var. murrayana-Populus tremuloides (Pinus jeffreyi)* Mapping Unit**

Note: Aggregation type including original PI code 3011

3011 - Sierra Lodgepole Pine-Quaking Aspen-Jeffrey Pine Forest Mapping Unit (Zone 8)

Note: Aggregated to type 3010 (Alliance level) in PIFinal field



**3011 – Sierra Lodgepole Pine-Quaking Aspen-Jeffrey Pine Forest Mapping Unit**

Depicted here in its most typical setting (an eastside riparian expression) dominated by Sierra lodgepole pine with lesser amounts of Jeffrey pine and quaking aspen. Quaking aspen yields a brighter red IR signature than the adjacent pines.

Observed during the field reconnaissance in glacially cut canyons, often adjacent or in close proximity to meadows. Most mapping units are fairly narrow, but often quite extensive. This type is highly variable, with any of the three tree species dominating, forming either an even mix or irregular pattern.

Taxa – At least 1 to 10% of Sierra lodgepole pine and quaking aspen and Jeffrey pine all occurring within the mapping unit. Jeffrey pine is often the dominant at the lower limits of this type, and along the drier margins of the corridor. The presence of quaking aspen is variable and can occasionally be dominant in wetter sites.
Microclimate – Important type in areas of cold air drainage, where Sierra lodgepole pine extends below its normal elevation range
Elevation – Lower portions of Zone 7, all of Zone 8, and locally in Zone 4
Slope Position – Adjacent to or near perennial water courses
Steepness – Level to slight
Hydrology – Seasonally to permanently flooded stream courses, temporarily flooded toward margins.
Frequency – Common, and extensive as narrow mapping units

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine–Quaking Aspen/Meadow Mapping Unit (3012) – is generally upstream from this type in somewhat more mesic meadow like environments.

Key Photo Signature Notes: Note presence of two conifers, Jeffrey pine having the larger crown size and lighter signature than associated Sierra lodgepole pine. Quaking aspen has the typical brighter red signature of hardwood species.

## 3012 - Sierra Lodgepole Pine-Quaking Aspen/(Kentucky Bluegrass) Forest Mapping Unit (Zone 8)

***Pinus contorta var. murrayana – Populus tremuloides/* (*Poa pratensis)* Forest Mapping Unit**

Stands of Sierra lodgepole pine were observed during the field reconnaissance along edges of most meadows above 8000 feet. Smaller meadows often were lined with only narrow bands of Sierra lodgepole pine. Usually, this type was ecotonal to other drier communities adjacent to meadows.

**3012 – Sierra Lodgepole Pine-Quaking Aspen/(Kentucky Bluegrass) Forest Mapping Unit**

Darker trees depict Sierra lodgepole pine in this scene with the lighter trees the less common quaking aspen. Mapped in a wide variety of stand structure and composition. This stands grades into a willow meadow unit to the northeast.

Taxa – Sierra lodgepole pine in sparse to moderately dense stands (locally dense in small areas) with an understory of drier meadow herbaceous species including Baltic rush (*Juncus* spp.), bluegrass (*Poa* spp.), and Douglas sedge (*Carex* spp.). Understory meadow layer is usually over 60 % absolute cover. Quaking aspen is a variable component to the canopy or subcanopy of at least 5-10% relative canopy cover.
Microclimate – Severe cold air drainage causes Sierra lodgepole pine to occur in lower elevation meadows below its normal elevation range.
Elevation – Middle portions of Zone 7 to upper portions of Zone 8
Slope Position – Low slopes
Steepness – Flat
Hydrology – Temporarily flooded or saturated along meadow edges.
Fire – Infrequent fire, returning to Sierra lodgepole pine quickly.
Frequency – Fairly common, mapping units however are often below MMU.

Note, the following similar map units can be confused with this type:

- Herbaceous meadow signature mapping units (7000's, 8000's, 9000's) – not associated with conifers, but may be adjacent.
- Sierra Lodgepole Pine–Quaking Aspen–Jeffrey Pine Riparian Mapping Unit (3011) - generally occurs in a more riparian setting at lower elevations
- Quaking Aspen–Jeffrey Pine/(Big Sagebrush) Forest Association (2015) - occurs in drier environments at lower elevations and has no Sierra lodgepole pine component.

Key Photo Signature Notes: Look for mix conifer-hardwoods in meadow environments too wet to sustain a component of Jeffrey pine.

## 3020 - Sierra Lodgepole Pine Forest Alliance (Zones 4, 5 & 7)
***Pinus contorta var. murrayana* Forest Alliance**

### 3021 - Sierra Lodgepole Pine Sparse Outcrop Woodland Mapping Unit (Zone 4)
***Pinus contorta var. murrayana* Sparse Outcrop Woodland Mapping Unit**
Note: Aggregated to type 3026 in PIFinal field

**3021 – Sierra Lodgepole Pine Sparse Outcrop Woodland Mapping Unit**

This extremely sparse woodland can have as little as 1-2% absolute cover trees. In this setting, approximately 5-10% cover, there is a minor western white pine component.

Associations: Sierra Lodgepole Pine/Mountain Pride Penstemon Forest Association

Taxa - Extremely sparse Sierra lodgepole pine usually below 5% absolute crown cover, western white pine may be a rare co-associate in the tree layer. Shrub cover is minimal, usually no huckleberry oak.
Elevation – Generally above 9000 feet, Zone 4
Soil – Large amounts of surface rock
Aspect – All
Shape – Generally convex
Slope Position – Usually broad flat upper slopes
Steepness – 5-30%
Geology – Granitic rock
Frequency – Common, polygons are moderate to large in size

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine Woodland Association (3038) - is found at lower elevations, generally has a denser crown cover, often has California red fir as an associate tree species, and is usually found in lower slope glacial rubble. Sierra lodgepole pine woodland polygons are generally smaller and usually surrounded by dense to moderately open stand conifers.
- Western White Pine Woodland Alliance (3130) – both types generally have an extremely sparse tree layer. Western white pine in harsh settings does not attain its full height thus making it difficult to discern on the aerial photos.
- Western White Pine-Sierra Lodgepole Pine Woodland Association (3132) – has a moderately open canopy and usually occurs on more defined ridgelines and spurs.
- Sierra Juniper & Sierra Juniper/Oceanspray Woodland Superassociation (4101) – also has an extremely sparse tree layer and may be difficult to accurately delineate the boundary between the 3021 and 4101 in extremely sparse settings. Environmental correlations between Sierra juniper and Sierra lodgepole pine types suggest that Sierra juniper is more frequently observed on steep sideslopes, often west-, south-, and east-facing, while lodgepole settings are more gently sloping.

## 3022 - Sierra Lodgepole Pine/(Bog Blueberry) Forest Mapping Unit (Zone 4)

***Pinus contorta var. murrayana/(Vaccinium uliginosum ssp. occidentale*) Forest Mapping Unit**

Associations: Sierra Lodgepole Pine/Bog Blueberry Forest Association

Noted in sparse to moderately closed settings immediately adjacent or throughout small to large meadows west of the crest throughout zone 4 and locally in zone 3.

Taxa – Sierra lodgepole pine in sparse to moderately dense stands (locally dense in small areas) with an understory of wet meadow species including bog laurel (*Kalmia polifolia*) and Northwest Territory sedge. Understory meadow layer is usually over 60 % absolute cover.
Microclimate – Severe cold air drainage causes Sierra lodgepole pine to occur in lower elevation meadows below its normal elevation range.
Elevation – As low as 6000 feet in cold air basins, (Crane Flat) up to nearly 10000 feet
Slope Position – Low
Steepness – Flat
Hydrology – Temporarily flooded or saturated along meadow edges.
Fire – Infrequent fire, returning to Sierra lodgepole pine quickly.
Frequency – Fairly common, mapping units however are often below MMU.

**3022 – Sierra Lodgepole Pine/(Bog Blueberry) Forest Mapping Unit**

A sparse overstory of Sierra lodgepole pine surrounds the meadow with a variable herbaceous understory.

Note, the following similar map units can be confused with this type:

- Herbaceous meadow signature mapping units (7000's, 8000's, 9000's) – not associated with conifers, but may be adjacent.
- California Red Fir–Sierra Lodgepole Pine/Whiteflowered Hawkweed Forest Association (4063) - is less mesic and contains a California red fir component in the overstory. Normally not adjacent to meadows except in constricted topography.
- Sierra Lodgepole Pine Mesic Expression Mapping Unit (Superassociation) (3048) - is mapped where mesic stands of Sierra lodgepole pine are noted not immediately adjacent to meadows. This superassociation usually contains Sierra lodgepole pine in densities higher than in type 3022.
- Sierra Lodgepole Pine/Shorthair Sedge Woodland Association (3042) – is more xeric and reflects less infrared than wetter meadow species.

Key Photo Signature Notes: Herbaceous understory reflects highly in the IR towards the reds generally; Sierra lodgepole pine is quite variable in stand density and crown size.

## 3026 - Sierra Lodgepole Pine Woodlands Superassociation (Zones 4 & 7)

***Pinus contorta var. murrayana* Woodlands Superassociation**

Note: Aggregation type including original PI Codes 3021, 3038 & 3042

Noted in sparse to moderately open settings in a variety of settings

Taxa – Sierra lodgepole pine in sparse to moderately open stands over glacial rubble, extensive rocky areas or areas of shallow soil supporting small patches of shorthair sedge. Higher stands may have a minor component of Sierra juniper in the canopy. Shrub canopy is generally minimal with ocean spray an indicator to rockier settings.
Elevation – 7000 to 10000 feet
Aspect – Variable
Shape – Neutral to convex
Slope Position – Low to Upper
Steepness – Level to moderately steep
Hydrology – Upland
Fire – Infrequent fire, returning to Sierra lodgepole pine quickly.
Frequency – Very common and extensively mapped aggregated type

Note, the following similar map units can be confused with this type:

- Sierra juniper sparse stands with a Sierra lodgepole pine component

Key Photo Signature Notes: Herbaceous understory is generally minimal except local dense patches of shorthair sedge in higher stands. Rockiness is key to mapping this aggregation. This superassociation is aggregated from three similar Sierra lodgepole pine types that tend to occur on rocky, exposed sites. Sierra lodepole pine has an irregularly shaped crown that ranges in color from dark red to dark brown. The Sierra lodgepole pine trees are typically small in stature, open and sparse and surrounded by vast areas of rock that contain tiny seeps where patchy shrubs may occur. When present, the dense herbaceous layer yields little or no infrared reflectance late in the growing season so its signature appears white or cream colored. Red fir, which can be a canopy component, contrasts as a pinker color against the more common Sierra lodgepole pine.

## 3027 - Sierra Lodgepole Pine/(Big Sagebrush-Roundleaf Snowberry-Currant-Red Mountainheather) Forest Mapping Unit (Zones 4 & 7)

***Pinus contorta var. murrayana/Artemesia tridentata - Symphoricarpos rotundifolius - Ribes spp. - Phyllodoce breweri* Forest Mapping Unit**

Noted near Tioga Pass, especially east of the park entrance and into Zone 7.

Taxa – Partial listing below, see Potter (1998) for listing of characteristic taxa for Sierra lodgepole pine/sagebrush association (Potter sample size = 11). Tree cover in Potter type ranged from 18-68%, averaging 44%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Sierra lodgepole pine | 100 | 31 |
| California red fir | 54 | 21 (Not observed at YOSE) |
| Tree Understory | | |
| Sierra lodgepole pine | 64 | 1 |
| California red fir | 64 | 4 |
| Jeffrey pine | 27 | 1 |
| Shrubs | | |
| Big sagebrush | 91 | 18 |
| Wax currant | 64 | 3 |
| Mountain snowberry | 45 | 4 |
| Antelope bitterbrush | 36 | 1 |
| Forbs | | |
| Pioneer rockcress | 73 | 3 |
| Mountain monardella | 64 | 6 |

Elevation – 7560-9480 feet, Zone 4 & 7
Soil – 37” average depth
Aspect – SE, SW
Shape – Usually convex
Slope Position – Lower slopes
Steepness – 11-40%, average = 22%
Frequency – More common east of the crest and in the Southern Sierra Nevada.

Note, the following similar map units can be confused with this type:

- Dry Sierra lodgepole pine situations in close proximity to big sagebrush where big sagebrush is not actually a component of the Sierra lodgepole pine understory.
- Sierra Lodgepole Pine/Ross Sedge Forest Association (3041) – has a denser canopy cover with a sparse herbaceous understory.
- Sierra Lodgepole Pine Xeric Expression Mapping Unit (Superassociation) (3049) – is generally used at lower elevations and more frequently on the west side.

- Many examples of whitebark pine/big sagebrush were noted and placed into the whitebark pine alliance; no floristic or mapping association exists for this type.

## 3028 - Sierra Lodgepole Pine-(Whitebark Pine)/(Ross Sedge-Shorthair Sedge) Forest Superassociation

***Pinus contorta var. murrayana–(Pinus albicaulis)/(Carex rossii-Carex exserta)* Forest Superassociation**

Note: Aggregation type including original PI Codes 3033, 3041 & 3043

A high elevation Sierra lodgepole pine or mixed Sierra lodgepole pine-whitebark pine woodland occurring in a variety of settings.

Taxa – Sierra lodgepole pine is a sole dominant at lower elevations and often shares dominance in the canopy with whitebark pine in the highest elevations. In less rocky settings, Ross sedge may be an understory component along with Parry's rush. In rocky environments, shorthair sedge may occupy small pockets of soil in locally dense patches with an open cover of Sierra lodgepole pine.
Microclimate – Sub Mesic
Elevation – 8500 to 11000 feet
Aspect – Variable
Shape – Neutral to convex
Slope Position – Low to Upper
Steepness – Level to moderately steep
Hydrology – Upland
Fire – Infrequent fire, returning to Sierra lodgepole pine quickly.
Frequency – Very common and extensively mapped aggregated type

Note, the following similar map units can be confused with this type:

- Sierra juniper sparse stands with a Sierra lodgepole pine component
- Whitebark pine types with a component of Sierra lodgepole pine

Key Photo Signature Notes: This is an aggregated type where Sierra lodgepole pine generally dominates; individual crowns at these higher elevations tend to be narrow. In ideal settings, significant components of whitebark pine appear as broader crowned trees with a somewhat lighter red photo signature. In settings where Ross sedge is inferred, soils are generally better developed and less rocky and pine cover can be fairly dense. In settings where shorthair sedge occurs, soils are patchy and interspersed with extensive rock. Pines in these stands tend to be more open. Dense patches of shorthair sedge yield a yellowish or cream-colored signature on the late season aerial photography.

## 3033 - Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest Association (Zones 4, 5 & 7)

***Pinus contorta var. murrayana - Pinus albicaulis/ Carex rossii* Forest Association**

Note: Aggregated to type 3028 in PIFinal field

**3033 = Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest Association**

In this example, whitebark pine mixes evenly with Sierra lodgepole pine in the upper portion of the photo; Sierra lodgepole pine dominates towards the lower portion.

In Zone 4, observed near the eastern park entrance on moraine deposits at 9800' (below normal elevation due to exposure and cold air drainage), and above 10,000 feet on east-facing slopes on the Gaylor Peak trail.

In zone 7, stands of Sierra lodgepole pine and whitebark pine mix were observed as fairly extensive units above the 9700 foot level about ½ mile below (east) of Trembel Lake in the upper portions of the Virginia Creek drainage.

Taxa – Moderately closed to open stands of Sierra lodgepole pine and whitebark pine of at least 10% relative cover of each species. Note: Ross sedge is an indicator species and is present in the understory at least 75% of the time.
Microclimate - Generally transitional between upper montane and subalpine
Elevation – Usually above 9800 feet
Aspect – Variable depending on elevation
Shape – Variable
Slope Position – Mid to upper slopes depending on elevation
Steepness – Moderate to moderately steep
Hydrology – Well drained
Frequency – Common and often extensive at upper elevations especially east of the crest

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine/Ross Sedge Forest Association (3041) - at higher elevations type 3041 grades into this mix of Sierra lodgepole pine and whitebark pine, which is usually slightly more open.
- Whitebark Pine//Ross Sedge Woodland Association (3146) – occurs at slightly higher elevations. Since the Sierra lodgepole pine and whitebark pine are in some cases difficult to discern on the aerial photography (whitebark pine without multiple trunks or "flat tops") getting a good break between the two types may be difficult.
- Sierra Lodgepole Pine–Whitebark Pine/Shorthair Sedge Forest Association (3043) - generally occupies a somewhat more meadow edge environment with a higher density herbaceous understory.
- Sierra Lodgepole Pine Sparse/Outcrop Woodland Mapping Unit (3021) - generally is found at slightly lower elevations, usually in rockier environments. Settings where density cover is extremely sparse makes it difficult to distinguish the two tree species.

Key Photo Signature Notes: Whitebark pine usually trends a bit lighter in signature has a more irregular crown. Transitions between types 3033 and 3041 often contain a significant whitebark pine component in the understory tree layer, not visible on the photography.

## 3038 - Sierra Lodgepole Pine Woodland Association (Zone 4) (Potter 1998)

***Pinus contorta var. murrayana* Woodland Association**

Note: Aggregated to type 3026 in PIFinal field

Observed in areas of broken surface rock such as moraines along Glacier Point and Tioga roads. Also noted in the Devils Postpile National Monument.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 10). Tree cover ranged from 16-48%, averaging 33%.

| | Cons | Cover |
|---|---|---|
| Tree Overstory | | |
| Sierra lodgepole pine | 100 | 26 |
| California red fir | 50 | 15 |
| Tree Understory | | |
| Sierra lodgepole pine | 70 | 1 |
| California red fir | 70 | 1 |
| Shrubs | | |
| Wax currant | 20 | 1 |
| Forbs | | |
| Pussypaws | 50 | 2 |
| Pinewoods lousewort | 50 | 1 |

**3038 – Sierra Lodgepole Pine Woodland Association**

Mapped in one of several settings, this stand is over more consolidated rock than most. This example is also nearly pure Sierra lodgepole pine with less than 1% cover of western white pine.

Elevation – 7360–9080 feet (generally above 7500 feet), Zone 4
Soil – Large amounts of surface rock, 33”
Aspect – All
Shape – Generally convex
Slope Position – Generally low (in basins) but occasionally on broad flat tops of domes above 8500 feet that contain little or no western white pine.
Slope Steepness – 5-30%
Geology – Moraine
Frequency – Common, polygon size is variable, but rarely large

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine Xeric Expression Mapping Unit (Superassociation) (3049) – open stands may be fairly rocky but are usually mapped in post change environments or where densities are somewhat higher than type 3038.
- Sierra Lodgepole Pine Sparse/Outcrop Woodland Mapping Unit (3021) - is usually found at higher elevations, has a lower tree cover and is generally found on mid and upper slopes or broad flat tops.
- California Red Fir–Sierra Lodgepole Pine/Whiteflowered Hawkweed Forest Association (4063) – drier fringes usually contain a higher percentage of California red fir.

- Western White Pine–Sierra Lodgepole Pine Woodland Association (3132) - with sparse cover of western white pine is normally found on a somewhat more severe slope, usually at higher slope positions also.
- Mapped to Sierra Lodgepole Pine Forest Alliance (3020) or Sierra Lodgepole Pine Xeric Expression Mapping Unit (Superassociation) (3049) in low elevation basins (below 6500') where Jeffrey pine is noted with Sierra lodgepole pine.

Key Photo Signature Notes: This type always has a sparse herbaceous understory with little or no shrub component. Look for glacial rubble as a more indicative environment than consolidated rock although this type can occur on either. Occurs on volcanics in Devils Postpile National Monument.

## 3041 - Sierra Lodgepole Pine/Ross Sedge Forest Association (Zones 4 & 7)

***Pinus contorta var. murrayana/Carex Rossii* Forest Association**

Note: Aggregated to type 3028 in PIFinal field

Found in the middle and upper portions of Virginia Creek, small portions of Green Creek and in areas above Upper Summers Meadow between 8000 and 9500 feet. Stands were usually pure and often quite extensive. Lodgepole needleminer damage noted in many stands, often extensive.

Taxa – Dense stands of Sierra lodgepole pine of at least 60% cover, with less than 5% cover of whitebark pine towards the upper edges of the stands. Sparse dry herbaceous understory layer.
Elevation – Generally between 8500 and 9500 feet, Zone 4 & 7
Soil – Well to moderately drained
Aspect – North trending at the lower elevations, southerly at higher elevations
Shape – Usually slightly convex
Slope Position – Lower to mid, below mixed stands of Sierra lodgepole pine and whitebark pine
Steepness – Slight to moderate
Geology – Granitic
Fire – Infrequent
Frequency – Very common on the east side; common also on gentle slopes north of Tuolumne Meadows.

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest Association (3033) - at higher elevations type 3041 grades into this mix of Sierra lodgepole pine and whitebark pine, which is usually slightly more open.

**3041 – Sierra Lodgepole Pine/Ross Sedge Forest Association**

A rather dry Lodgepole type, usually in dense woodlands or forests of pure Sierra lodgepole pine. This example is along the Virginia Lakes Road below Virginia Lakes at about 9200 feet.

- Sierra Lodgepole Pine/Big Sagebrush Forest Association (3034) – has a more open canopy. Big sagebrush is a component of the understory. Type 3034 also can be found above 9000 feet elevation.
- Other dry lodgepole types (such as Potter's Sierra lodgepole pine association) also contain a Ross sedge understory but are generally found at lower elevations, sometimes with another minor conifer component.
- Sierra Lodgepole Pine/Shorthair Sedge Woodland Association (3042) - generally occurs closer to meadows; however splitting these two types can often be difficult and transitions between the two quite extensive.

Key Photo Signature Notes: This appears to be the most common type that has undergone extensive Needleminer damage especially on the Westside above Tuolumne Meadows. Often this association forms dense woodlands and dry forests where the one species of conifer maintains a consistent crown size throughout the stand. IR signature varies little throughout a typical stand but generally increase as it grades into more mesic stands.

## 3042 - Sierra Lodgepole Pine/Shorthair Sedge Woodland Association (Zones 4 & 7)

***Pinus contorta var. murrayana/Carex exserta* Woodland Association**

Note: Aggregated to type 3026 in PIFinal field

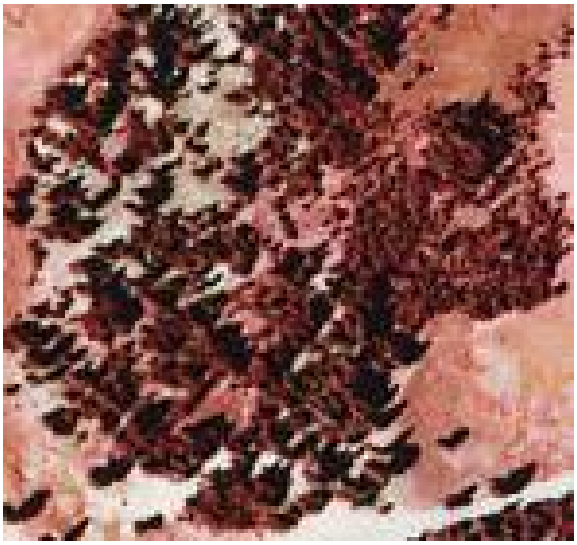
Several small examples (some above the MMU) were observed in association with Dana Meadows and Tuolumne Meadows in zone 4.

Taxa – Sierra lodgepole pine in moderate to open stands over usually dense stands of shorthair sedge.
Elevation – Above 9000 feet, Zone 4 & 7
Aspect – Variable
Shape – Variable
Steepness – Level to slight
Hydrology – Temporarily saturated
Frequency – Uncommon and generally restricted in size

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine/(Western Blueberry) Meadow Edge Mapping Unit (3022) - is usually associated with wetter meadow species and reflect more infrared off the photography.
- Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest Association (3043) – is found at higher elevations and contains at least 5-10% cover of whitebark pine.

Key Photo Signature Notes: Drier than type 3022; note dense herbaceous signature yielding little or no IR (white to cream colored). Generally restricted in size.



**3042 – Sierra Lodgepole Pine/Shorthair Sedge Woodland Association**

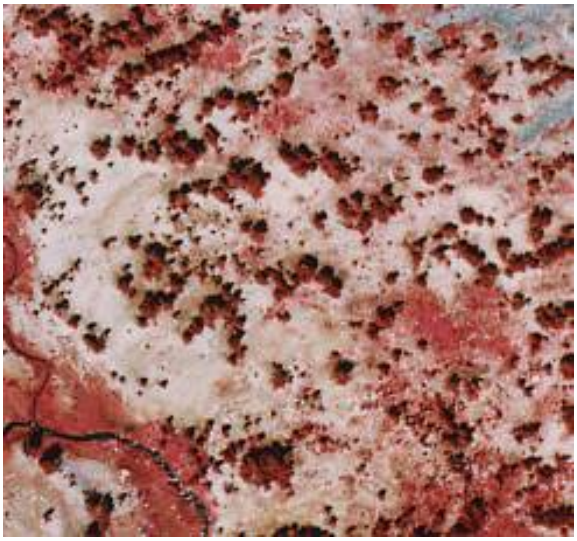
This example transitions from Sierra lodgepole pine over shorthair sedge (the lighter signature) to Sierra lodgepole pine over wetter meadows (the orange herbaceous signature)

## 3043 - Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest Association (Zones 4 & 5)

***Pinus contorta var. murrayana-Pinus albicaulis/Carex exserta* Forest Association**

Note: Aggregated to type 3028 in PIFinal field

Taxa – At least 10% relative cover of both Sierra lodgepole pine and whitebark pine; generally with a moderate to dense herbaceous layer except when interrupted by rocky outcroppings.
Microclimate – Effects of cold air basins may result in stands at lower than expected elevations
Elevation – 9600 to 10500 feet, Zone 4
Aspect – Variable
Shape – Neutral
Slope Position – Mid to upper slopes
Steepness – Moderate
Frequency – Common in upper portions of Zone 4, less common in zone 7



**3043 = Sierra Lodgepole Pine–Whitebark Pine/Shorthair Sedge Forest Association**

This example depicts the Sedge as a cream colored understory to an even mix of whitebark and Sierra lodgepole pine. whitebark pine is more dominant in the upper right portion of the picture.

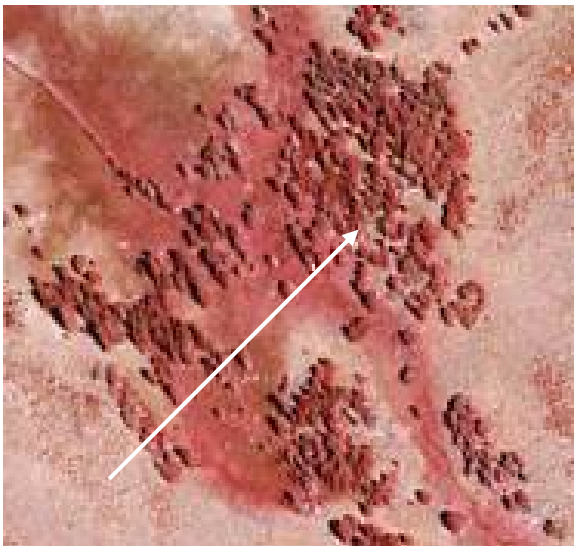
Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine Xeric Expression Mapping Unit (Superassociation) (3049) - is generally mapped with an understory that appears white in the photography
- Sierra Lodgepole Pine/Shorthair Sedge Woodland Association (3042) - is mapped at lower elevations and is usually more restricted in size
- Sierra Lodgepole Pine–Whitebark Pine/Ross Sedge Forest Association (3033) - is found in drier settings and usually has a more closed canopy

Key Photo Signature Notes: Note variable tree species composition (Sierra lodgepole and whitebark pine) and dry sedge understory. Canopy density is also variable, often patchy in the stand.

## 3047 - Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Mapping Unit (Zone 7 & 8)

***Pinus contorta var. murrayana/(Artemisia tridentata)/(Poa pratensis)* Mapping Unit**



**3047 Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Mapping Unit**

This example depicts a variable meadow understory to a moderately sparse to rather dense Lodgepole woodland overstory.

Mapped on the eastside primarily in zone 7 and upper portions of zone 8 where Sierra lodgepole pine occurs in meadow environments.

Taxa – Sierra lodgepole pine in sparse to moderately dense stands with an understory of drier meadow herbaceous species including rushes (*Juncus* spp.), bluegrasses (*Poa* spp.), and sedges (*Carex* spp.). Understory meadow layer is usually over 60% absolute cover. Note this type will be limited to the proximity of meadows only.
Microclimate – Can occur locally below normal elevation range due to cold air drainage factors
Elevation – Generally above 7000 feet, Zone 7 & 8
Shape – Neutral to concave
Slope Position – Valley bottoms to toe slopes at meadow edges
Steepness – Flat to gently sloping
Hydrology – Associated with drainages
Fire – Infrequent fire, returning to Sierra

lodgepole pine quickly
Frequency – Common but mapping units extremely narrow, often only one or two individual trees wide before upland change

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine Mesic Expression Mapping Unit (Superassociation) (3048) – is usually not restricted to meadow edges, canopy cover is usually denser and polygons are larger.
- Quaking Aspen-Jeffrey Pine/(Big Sagebrush) Forest Association (2015) – may be adjacent to 3047 upslope or in more riparian settings.
- Sierra Lodgepole Pine-Quaking Aspen Mapping Unit (3010) - have a hardwood component (aspen) that is usually recognizable on the photography.

## 3048 - Sierra Lodgepole Pine Mesic Forest Superassociation (Zone 4)

***Pinus contorta var. murrayana* Mesic Forest Superassociation**

Associations: Sierra Lodgepole Pine/Western Bog Laurel Forest Association, Sierra Lodgepole Pine/Gray Lovage Forest Association.

Observed throughout the study area at elevations over 7500 feet, and locally below 7500 feet in cold air drainages associated with, but not adjacent to, meadow environments. This mapping unit is a lumping of mesic Sierra lodgepole pine types such as Sierra lodgepole pine/Gray lovage, Sierra lodgepole pine/western bog laurel associations, and the former Sierra lodgepole pine/Fendler meadow-rue association. Generally observed in dense woodland to forest settings.

Taxa – Sierra lodgepole pine in fairly dense to closed stands over a mesic layer of herbaceous species with a generally sparse shrub layer.
Microclimate –
Elevation – Generally between 7500 and 9800 feet, Zone 4
Shape – Neutral to concave
Slope Position -
Steepness – Flat to slight
Hydrology – Mesic but rarely flooded or saturated
Frequency – Common and extensive, but less so than Sierra lodgepole pine xeric expression mapping unit (superassociation).

Note, the following similar map units can be confused with this type:

**3048 = Sierra Lodgepole Pine Mesic Forest Superassociation**

Typical stands such as this one are dense forests with a wet (pink signature) understory visible in places throughout the stand.

- This mapping unit was created to address the mesic types that are not distinguishable on the aerial photography.
- Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Meadow Edge Mapping Unit (3047) - is associated with meadows only, and is mapped only in Zones 7 & 8.
- Sierra Lodgepole Pine/(Western Blueberry) Meadow Edge Mapping Unit (3022) – is associated with meadows only.
- Sierra Lodgepole Pine Xeric Expression Mapping Unit (Superassociation) (3049) – has a sparse herbaceous understory. Both types can have fairly dense to closed stands of Lodgepole Pine.
- California Red Fir– Sierra Lodgepole Pine/Whiteflowered Hawkweed Forest Association (4063) -contains a canopy component of California red fir and is usually more common at lower elevations (from 7000 – 8500 feet where California red fir is common).

Key Photo Signature Notes: Look for dense stands of pure or nearly pure Sierra lodgepole pine where small openings in the canopy reveal a mesic (pink) herbaceous signature.

## 3049 - Sierra Lodgepole Pine Xeric Forest Superassociation (Zone 4)

***Pinus contorta var. murrayana* Xeric Forest Superassociation**

Associations: Sierra Lodgepole Pine Forest Association, Sierra Lodgepole Pine/Ross Sedge Forest Association.

Observed at its lower elevations in cold air basins, and extensively along the Tioga Pass road above 7800 feet (Porcupine Flat). Extensive stands viewed at a distance west of Granite Lakes. Needleminer damage noted in many stands, often extensive. This mapping unit is a lumping of dry Sierra lodgepole pine types such as Sierra lodgepole pine forest association, and Sierra lodgepole pine/Ross sedge forest association.

Taxa – Sierra lodgepole pine over an upland (dry mesic) sparse herbaceous understory. Mapped also in transitional settings where other conifers (especially juniper and Jeffrey pine are a component to the tree layer).
Microclimate – Lower elevations in cold air basins (Porcupine Flat)
Elevation – Above 7800; up to 9700 feet where it starts mixing with whitebark pine, Zone 4
Aspect – Variable, depending on elevation
Shape – Variable, usually slightly convex

Slope Position – Middle to lower slopes usually
Steepness – Gentle to moderate
Frequency – Sierra lodgepole pine may be the most abundant tree species in Yosemite National Park based on mapping.

**3049 - Sierra Lodgepole Pine Xeric Forest Superassociation**

This category is used where understory signature (white to gray) yields little or no IR in widely variable settings. Often mapped where Sierra lodgepole pine occurs below its normal elevation or where association level mapping cannot be determined.

Note, the following similar map units can be confused with this type:

- This mapping unit was created to address the dry mesic types that are not distinguishable on the aerial photography.
- Sierra Lodgepole Pine Mesic Expression Mapping Unit (Superassociation) (3048) – mesic herbaceous understory with a generally sparse shrub layer. Both types can have fairly dense to closed canopy of Sierra lodgepole pine.
- Sierra Lodgepole Pine Woodland Association (3038) - is normally more open and may contain a component of California red fir.
- Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest Association (3043) – mapped at higher elevations, having a lighter signature to the herbaceous understory.
- Sierra Lodgepole Pine/Big Sagebrush Forest Association (3034) – has a more open canopy cover. Also has big sagebrush as a component of the understory, and is generally limited to east of the crest.
- Sierra Lodgepole Pine/Ross Sedge Forest Association (3041) - can be mapped with relative confidence at higher elevations in dense woodland settings especially east of the crest.
- Sierra Lodgepole Pine Sparse/Outcrop Woodland Mapping Unit (3021) - should be used in settings where the tree layer is extremely sparse in rocky environments

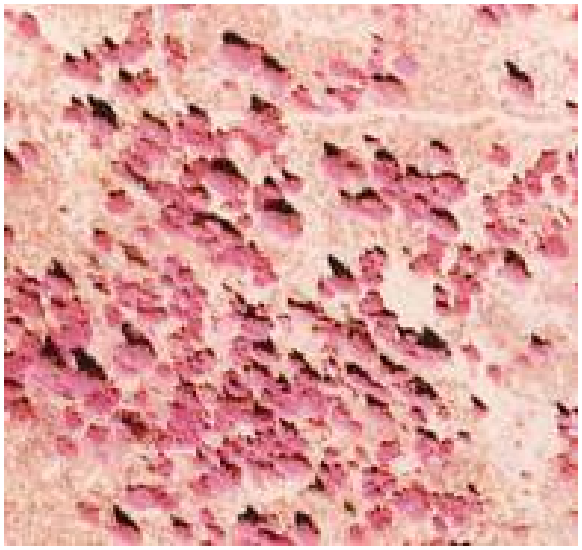
Key Photo Signature Notes: Assign this type where association level mapping is dubious – such as in lower than normal elevations where understory openings appear light on the photography or in recent post change (disturbance) settings, or where other conifer species are a significant (5-10%) that do not fit associations such as Jeffrey pine.

## 3050 - Ponderosa Pine Woodland Alliance (Zone 2)
***Pinus ponderosa* Woodland Alliance**

### 3053 - Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association (Zone 2)
***Pinus ponderosa-Quercus kelloggii/Arctostaphylos viscida* Woodland Association**

Several small examples were observed throughout the lower portions of Zone 2 in extremely dry settings. California black oak or canyon live oak were also noted as a tree component in several stands.

Taxa – Emergent stand of ponderosa pine in sparse to extremely sparse stands from 5-25% over a shrub layer dominated primarily by whiteleaf manzanita. Shrub understory layer varies from 5-50%. May contain a component of canyon live oak or California black oak.
Microclimate – Extremely xeric for a Zone 2 type
Elevation – Upper portions of Zone 1 and throughout Zone 2
Soil – Poorly developed and fairly rocky
Aspect – South to southwest
Shape – Convex
Steepness - Moderately steep to steep
Geology – n/a
Hydrology – Upland
Frequency –Common but stands are usually not extensive



**3053 – Ponderosa Pine California Black Oak/Whiteleaf Manzanita Woodland Association**

A typical example; sparse ponderosa pine with a fairly dense understory of manzanita. In this example as in many, black oak is a significant component to the tree layer.

Note, the following similar map units can be confused with this type:

- Ponderosa Pine-Incense-cedar/Mountain Misery Forest (3062) – may contain greenleaf manzanita. It generally occurs at higher elevations above 5000 feet and in more mesic environments. Greenleaf manzanita understory shrub layer also yields a brighter IR signature than the whiteleaf manzanita type.
- Jeffrey Pine–Canyon Live Oak/Whiteleaf Manzanita Woodland Association (3084) - is found in much rockier environments generally north of Tuolumne River. Where both conifers co-occur, it is probably impossible to separate out.

Key Photo Signature Notes: Manzanita understory can be variable but is usually sparse; oaks (especially California black oak) can be a minor component. Conifer overstory is always sparse however.

## 3060 - Ponderosa Pine-Incense-cedar Forest Alliance (Zone 2)

***Pinus ponderosa – Calocedrus decurrens* Forest Alliance**

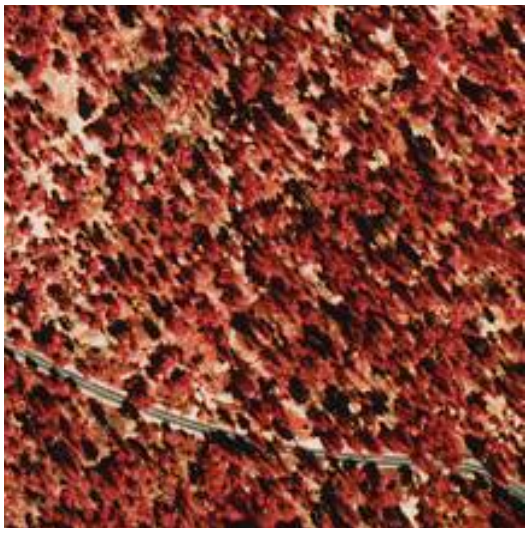
### 3061 - Ponderosa Pine-Incense-cedar-Canyon Live Oak/Mountain Misery Forest Association

***Pinus ponderosa – Calocedrus decurrens – Quercus chrysolepsis/Chamaebatia foliolosa* Forest Association**

Note: Aggregated to type 3066 in PIFinal field

Several small examples of this type were observed south of the town of Wawona on south facing slopes around 4500 feet. This type appeared to be located in fairly rocky settings, hence the presence of canyon live oak. California black oak appeared to replace the canyon live oak adjacent to the steeper rockier sites, however, mountain misery was seen in both settings.

Taxa – Moderately open to moderately closed stands of ponderosa pine and incense-cedar of at least 10-25% up to 40 to 60% cover. Also contains canyon live oak in stands of at least 5-10%, with at least 1-5% cover for each species of conifers and canyon live oak. Generally no California black oak, but less steep areas can have California black oak and multi-stemmed sedge. Sparse to dense understory cover of mountain misery.
Microclimate – A dry ponderosa pine–incense-cedar type
Elevation – Upper elevations of Zone 2
Soil – Poorly developed and rocky
Aspect – Southerly
Shape – Variable, locally concave in dry rocky ravines
Slope Position – Lower to mid slopes, more well drained
Steepness - Moderately steep to steep
Hydrology – Upland
Fire – Suppression accounting for more incense-cedar
Frequency – Somewhat common



**3061 = Ponderosa Pine–Incense-cedar–Canyon Live Oak/Mountain Misery Forest Association**

Similar to type 3062 but on steeper drier settings; usually both canyon and California black oak are co-dominant with ponderosa pine.

Note, the following similar map units can be confused with this type:

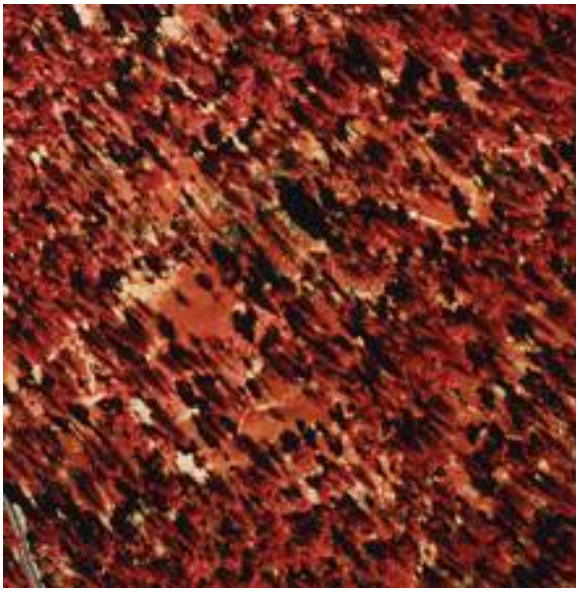
- Ponderosa Pine–Incense-cedar/Mountain Misery Forest (3062) - may contain sparse California black oak but occurs in more mesic environments, and canopy cover is probably, as a rule, more closed.
- Ponderosa Pine–Incense-cedar–California Black Oak Forest Association (3063) - at its drier edges can contain mountain misery, however at a much lower mean cover. It is also located in more mesic environments.
- Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association (3053) - is found in drier settings at lower elevations and contains a understory of whiteleaf manzanita.

Key Photo Signature Notes: A difficult type to map; look in steep settings with rocky ravines where canyon live oak often takes hold. California black oak is often in the oak canopy adjacent to the rocky canyon ravines. Conifer overstory density is often highly variable within the stand.

## 3062 - Ponderosa Pine-Incense-cedar/Mountain Misery Forest (Zone 2)

***Pinus ponderosa – Calocedrus decurrens/Chamaebatia foliolosa* Forest Association**

Note: Aggregated to type 3066 in PIFinal field



**3062 = Ponderosa Pine–Incense-cedar/Mountain Misery Forest**

An open stand showing the smooth signature of the mountain misery understory. This example contains little California black oak; others may have a significant component.

Examples of this type were seen in the Wawona area and also on the road to Cherry Valley. Many stands also contain California black oak.

Taxa – Ponderosa pine and incense-cedar occurring in a moderately open to nearly closed canopy with at least 5-10% of each species. Mountain misery understory density is highly variable depending on the openness of the canopy. No canyon live oak. Presence of California black oak is common.
Microclimate – Submesic
Elevation – Upper elevations of Zone 2
Soil – Mainly moderately well developed, but possibly poorly developed, but not rocky
Aspect – Generally southerly but not extreme
Shape – Variable
Slope Position –Mid to upper slopes
Steepness – Undulating to nearly level
Geology – n/a
Hydrology – Upland
Fire – Suppression accounting for presence of incense-cedar
Frequency – Fairly common to common and extensive

Note, the following similar map units can be confused with this type:

- Ponderosa Pine-Incense-cedar-California Black Oak Forest Association (3063) - is more mesic however dividing the two types can be extremely difficult. Canopy is more closed.
- Ponderosa Pine-Incense-cedar–Canyon Live Oak/Mountain Misery Forest Association (3061) - is more xeric and canyon live oak is visible in the canopy.
- Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association (3053) – contains whiteleaf manzanita. It generally occurs at lower elevations and in more xeric environments. Greenleaf manzanita understory shrub layer also yields a brighter IR signature than the whiteleaf manzanita type.

Key Photo Signature Notes: Very similar to type 3063; map only where mountain misery is visible in the understory openings. Openings to the canopy appear bright red, yielding a very smooth signature; however openings can be quite small and local in the stand.

## 3063 - Ponderosa Pine-Incense-cedar-California Black Oak Forest Association (Zone 2)

***Pinus ponderosa – Calocedrus decurrens – Quercus kelloggii* Forest Association**

Note: Aggregated to type 3066 in PIFinal field

**3063 – Ponderosa Pine–Incense-cedar-California Black Oak Forest Association**

This is a mesic example of this association, with a minor component of California black oak more noticeable in the northwest portion of the image.

Noted extensively in zone 2 near Wawona, in the Yosemite Valley and on the road to Crain Flats

Taxa – Mainly ponderosa pine with a lesser component of incense-cedar (70-90% conifer) usually with very closed crown cover (>70%). California black oak is often a minor component except in post fire openings. At upper elevations sugar pine is often an important canopy component. No white fir except in the understory.
Microclimate – Submesic to mesic
Elevation – Common and extensive alliance in Zone 2
Soil – Well developed
Aspect – Variable, north trending for the most part
Shape – Neutral to convex
Slope Position – Lower slopes
Steepness – Gentle to flat
Hydrology – Upland
Fire – Fire suppression stands result in a closed canopy structure and white fir in the understory
Frequency – Very common, and may be extensive

Note, the following similar map units can be confused with this type:

- Ponderosa Pine-Incense-cedar/Mountain Misery Forest (3062) – is less mesic and more open, with mountain misery in the understory.

- Ponderosa Pine-Incense-cedar-Canyon Live Oak/Mountain Misery Forest Association (3061) - is located in more xeric environments. Type 3063 at its drier edges can contain mountain misery, however at a much lower mean cover.
- White Fir–Sugar Pine-Incense-cedar Mapping Unit (Type 4094) is mapped when white fir becomes a significant canopy component, and ponderosa pine becomes less frequent (usually the least abundant canopy species). Transitions between the two types often cover extensive areas and may be difficult to accurately divide.

### 3066 - Ponderosa Pine – Incense-cedar-(California Black Oak – Canyon Live Oak) Forest Superassociation (Zone 2)

***Pinus ponderosa – Calocedrus decurrens –(Quercus kelloggii-Quercus chrysolepsis)* Forest Superassociation**

Note: Aggregation type including original PI Codes 3061, 3062 & 3063

Generally a forest or dense woodland of the lower mixed conifer belt occurring in a variety of settings.

Taxa – Ponderosa pine usually dominates the canopy; incense-cedar is a subordinate species, occasionally co-dominating in more mesic settings. Steeper settings, especially in rocky canyons and ravines may support an understory of canyon live oak while past fire activities in more mesic settings may support denser stands of black oak in the sub canopy.
Microclimate – Submesic
Elevation – Throughout zone 2
Aspect – Variable
Shape – Variable
Slope Position – Low to Upper
Steepness – Level to very steep
Hydrology – Upland
Frequency – Very common and extensively mapped aggregated type

Note, the following similar map units can be confused with this type:

- Drier ponderosa pine types without incense-cedar
- Higher mixed conifer types such as white fir – sugar pine with a ponderosa pine component

Key Photo Signature Notes: This is an aggregated type where ponderosa pine dominates the canopy in most settings. Incense-cedar is very difficult to distinguish in the conifer canopy, but can at times yield a brighter red signature (young pines also may yield similar signatures) and is some what more common in riparian settings. Canyon live and California black oak are generally separable (California black oak is generally a brighter red) in ideal settings but can be confusing where they co-occur.

### 3070 - Jeffrey Pine Woodland Alliance (Zones 3, 4 & 8)

***Pinus jeffreyi* Woodland Alliance**

## 3072 - Jeffrey Pine/Greenleaf Manzanita Woodland Association (Zone 3)

***Pinus jeffreyi/Arctostaphylos patula* Woodland Association**

Noted generally as a low elevation Jeffrey pine association, (in rocky areas north of Hetch Hetchy Reservoir located above stands of Jeffrey pine-canyon live oak/whiteleaf manzanita.

Taxa – Partial listing below, see Potter (1998) for listing of characteristic species. (Potter sample size = 32). Tree cover ranged from 10-79%, averaging 40%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Jeffrey pine | 84 | 25 |
| California red fir | 69 | 20 |
| White fir | 34 | 13 |
| Tree Understory | | |
| California red fir | 56 | 1 |
| Whtie fir | 41 | 1 |
| Jeffrey pine | 41 | 1 |
| Shrubs | | |
| Greenleaf manzanita | 72 | 19 |
| Snowbrush | 41 | 24 |
| Bush chinquapin | 38 | 11 |
| Forbs | | |
| Pioneer rockcress | 62 | 1 |

**3072 – Jeffrey Pine/Greenleaf Manzanita Woodland Association**

A typical open setting with a sparse overstory of Jeffrey pine over a sparse layer of shrubs; mainly greenleaf manzanita.

Elevation – 6660-9520 feet; Note: Potter defines this as a higher elevation than Jeffrey pine/huckleberry oak due to its abundance on the south and east side. At Yosemite, mapped in elevations generally from 5500 to 7500 feet, generally below the Jeffrey pine/huckleberry oak association.
Soil – Average = 32”
Aspect – SE, SW
Shape – At Yosemite generally convex
Slope Position – All positions
Steepness – 4-64%, average = 30%
Frequency – Less common at Yosemite than in the southern Sierra. Noted south of Mt. Starr King along trail paralleling Illilouette Creek. Definitely not observed on the east side.

Note, the following similar map units can be confused with this type:

- Jeffrey Pine/Huckleberry Oak Woodland Association (3075) - is generally at higher elevations; shrub signature is generally a brighter red.
- Jeffrey Pine/Whitethorn Ceanothus Woodland Association (3073) - has an understory shrub signature that is pinker than the greenleaf manzanita signature, and is generally found in a more recent post fire ecology.

- Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association (3084) – contains canyon live oak and is generally at lower elevations and on steeper, even rockier slopes.
- Ponderosa Pine-Incense-cedar/Mountain Misery Forest (3062) where these stands contain greenleaf manzanita are generally found in areas of better soil development off the balds but at times in similar elevations.

Key Photo Signature Notes: Greenleaf manzanita generally yields an IR signature intermediate between whiteleaf manzanita and huckleberry oak. Much less common than Jeffrey pine/huckleberry oak.

## 3073 - Jeffrey Pine/Whitethorn Ceanothus Woodland Association (Zone 3) (Potter 1998)

***Pinus jeffreyi/Ceanothus cordulatus* Woodland Association**

This type appears to be extremely uncommon at Yosemite, generally whitethorn ceanothus occurring much more commonly with white fir. Isolated patches mapped at elevations similar to those for Jeffrey pine/greenleaf manzanita woodland association (3072) and white fir-(California red fir-sugar pine-Jeffrey pine) whitethorn ceanothus-(pinemat manzanita-Ceanothus spp.) mapping unit (4084).

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 18)
Tree cover is 1-63%, averaging 36%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Jeffrey pine | 94 | 16 |
| California red fir | 89 | 15 |
| Sierra lodgepole pine | 28 | 9 |
| White fir | 22 | 17 |
| Tree Understory | | |
| California red fir | 67 | 1 |
| Jeffrey pine | 50 | 1 |
| Whtie fir | 28 | 1 |
| Shrubs | | |
| Whitethorn ceanothus | 56 | 20 |
| Big sagebrush | 39 | 14 |
| Yellow rabbitbrush | 22 | 10 |
| Antelope bitterbrush | 22 | 16 |
| Forbs | | |
| Pioneer rockcress | 72 | 1 |
| Coville’s groundsmoke | 61 | 3 |

Elevation – 6820–9360 feet, note that areas at Yosemite appear lower
Soil – Total depth average 35”
Aspect – NE, SE, SW
Shape – Convex
Slope Position – Lower and mid slopes

Steepness – 1-51%, average = 20%
Fire – Appears to be the most immediate post fire Jeffrey pine type.
Frequency – Uncommon, mapping units fairly small, associated with burns and logging disturbance in the National Forest lands

Note, the following similar map units can be confused with this type:

- Jeffrey Pine/Greenleaf Manzanita Woodland Association (3072) - has an understory signature that is more orange than that of the Jeffrey pine/whitethorn ceanothus association.
- Jeffrey Pine/Huckleberry Oak Woodland Association (3075) - has an understory shrub signature that is brighter red than that of the Jeffrey pine/whitethorn ceanothus association.
- White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/Whitethorn Ceanothus-(Pinemat Manzanita-Ceanothus spp.) Mapping Unit (4084) – is dominated by white fir in the canopy layer although other conifers (pine) often co-occurs.
- White Fir–Sugar Pine-(Incense-cedar)/Mixed Shrub (without whitethorn ceanothus) Open Woodland Mapping Unit (4095) - generally has a mix of conifers in the overstory.

## 3075 - Jeffrey Pine/Huckleberry Oak Woodland Association (Zone 3) [Potter]

***Pinus jeffreyi/Quercus vaccinifolia* Woodland Association**

Observed frequently on domes where Jeffrey Pine was usually fairly sparse, both huckleberry oak and Jeffrey pine varied greatly in density. Observed on Glacier Point Road at elevations from 7300 to 7600 feet. Mapped as Jeffrey pine/huckleberry oak woodland association when both shrub species (greenleaf manzanita and huckleberry oak) are present.

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 32). Tree cover is 8-67%, averaging 36%.

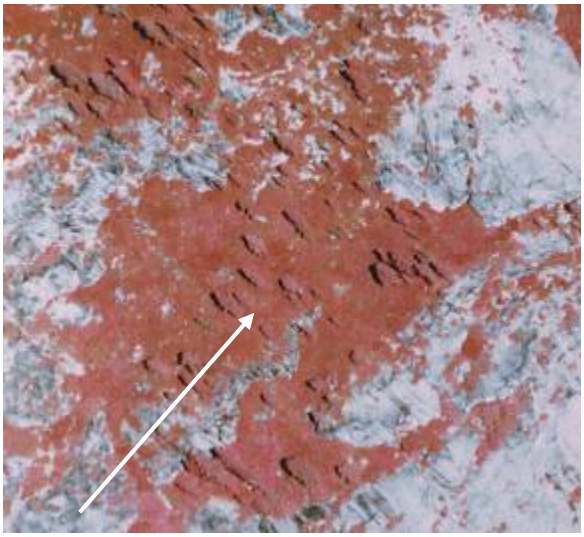
| Tree Overstory | Cons | Cover |
|---|---|---|
| Jeffrey pine | 88 | 15 |
| White fir | 69 | 16 |
| California red fir | 59 | 19 |
| Tree Understory | | |
| White fir | 78 | 2 |
| California red fir | 75 | 1 |
| Jeffrey pine | 38 | 1 |
| Shrubs | | |
| Huckleberry oak | 100 | 30 |

| | | |
|---|---|---|
| Pinemat manzanita | 62 | 29 |
| Whitethorn ceanothus | 38 | 4 |
| Bitter cherry | 31 | 1 |
| Creeping snowberry | 28 | 3 |
| Forbs | | |
| Pinewoods lousewort | 44 | 2 |

Note: red fir usually assoc. at YOSE (less white fir)

Note: Greenleaf manzanita a common associate at Yosemite (less pinemat manzanita)

Microclimate – Xeric
Elevation – 6300 – 8320 feet (7320 feet average)
Soil – Total depth average 32”
Aspect – Variable
Shape – Usually convex
Slope Position – Ridges and upper slopes
Steepness – 4-58%, average = 27%
Geology – Often associated at Yosemite with granitic domes
Hydrology – Upland
Frequency – Common, mapping unit sizes extremely variable



**3075 – Jeffrey Pine/Huckleberry Oak Woodland Association**

Mapped in a wide variety of settings; this stand represents a sparse overstory of Jeffrey pine over a dense understory of huckleberry oak. Many stands contain a significant tree component of California red fir.

Note, the following similar map units can be confused with this type:

- Jeffrey Pine/Whitethorn Ceanothus Woodland Association (3073) - is associated with recent burn and less rocky, and is generally found in lower slope positions. The shrub signature is also not as bright red as that of Jeffrey pine/huckleberry oak woodland association.
- Jeffrey Pine/Greenleaf Manzanita Woodland Association (3072) - is generally found at lower elevations and understory shrub signature is more orange than red.
- California Red Fir-Jeffrey Pine Woodland Association (3085) - may have huckleberry oak toward the drier edges, but is generally a more closed forest. Note that California red fir is a common tree component to 3075.
- California Red Fir-Western White Pine/Mixed Shrub Mapping Unit (Superassociation) (4069) – can be confused with 3075 samples with high California red fir component. Type 4069 occurs on less exposed sites. Jeffrey pine is rounder, fuller and less irregular than western white pine. Western white pine generally gives off more IR yielding a pinker signature.
- Sierra Juniper & Sierra Juniper/Oceanspray Woodland Superassociation (4101) – is difficult to distinguish from 3075 in sparse settings. Type 4101 is found on more severe slopes and in broken rocky environments. Presence of Sierra juniper is more significant than Jeffrey pine and a low relative cover would change the type from 3075 to 4101.

Key Photo Signature Notes: Highly variable shrub density; if shrub density is very high and tree cover extremely low, err with the huckleberry oak shrub type. If both species are sparse, err with the Jeffrey pine type. Where types 4101 and 3075 transition, it is extremely difficult to

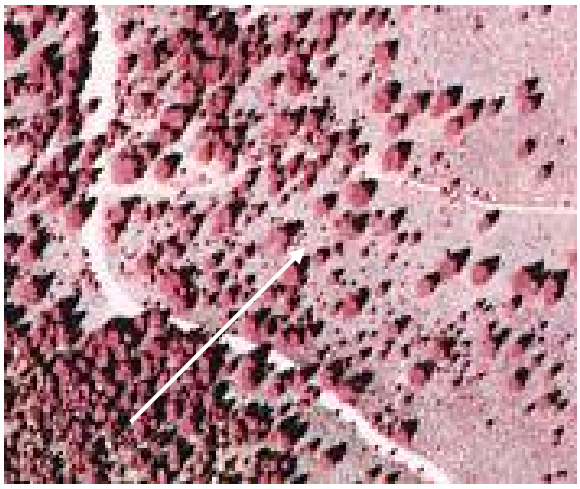
distinguish the Sierra juniper from the pine (they both take on similar structural forms). Generally, Sierra juniper yields slightly higher IR (deeper reds) and has a more irregular crown but overlap in IR and tree structure is high.

## 3076 - Jeffrey Pine/Antelope Bitterbrush Woodland Association (Zone 8)

***Pinus jeffreyi/Purshia tridentata* Woodland Association**

Observed throughout the east side environs during the field reconnaissance, usually in dry to dry mesic settings just above the singleleaf pinyon pine zone. Occasionally, singleleaf pinyon pine types occupy the more exposed adjacent hillsides.

Taxa – Emergent stands of Jeffrey pine in densities that are extremely sparse to moderately open (5-60%) over an understory of both big sagebrush and antelope bitterbrush. Normally antelope bitterbrush is more common but not always.
Microclimate – Xeric
Elevation – Most portions of Zone 8
Shape – Variable
Slope Position – Lower to middle portions, sometimes below exposed slopes of pinyon
Steepness – Slight to moderate
Hydrology – Upland
Frequency – Common



**3076 – Jeffrey Pine/Antelope Bitterbrush Woodland Association**

A dry eastside Jeffrey pine type ranging from a sparse to dense woodland, depicted here in an intermediate to sparse setting near Buckeye Springs.

Note, the following similar map units can be confused with this type:

- Jeffrey Pine-Curl-leaf Mountain Mahogany Woodland Association (3082) – has curl-leaf mountain mahogany component, and can occur at higher elevations than 3076.
- Jeffrey Pine–White Fir/Roundleaf Snowberry/Squirreltail Grass woodland Association (3083) has a higher density canopy layer with little or no shrub understory and at least a minimal presence of white fir.
- Jeffrey Pine-Singleleaf Pinyon Pine Woodland Association (3081)

## 3081 - Jeffrey Pine–Singleleaf Pinyon Pine Woodland Association (Zone 8)

***Pinus jeffreyi-Pinus monophylla* Woodland Association**

**3081 – Jeffrey Pine–Singleleaf Pinyon Pine Woodland Association**

Uncommon in lower elevations on the east side and often transitional between two types, this example depicts the larger Jeffrey pine mainly along the perimeters of the stand.

Observed during the field reconnaissance in Lee Vining Canyon and several areas to the south adjacent to pure stands of singleleaf pinyon pine or in close proximity to the Jeffrey pine/antelope bitterbrush woodland association (3076).

Taxa – Sparse emergent Jeffrey pine of at least 5% cover over fairly dense stands of singleleaf pinyon pine usually of at least 50% cover.
Microclimate – Xeric
Elevation – Lower portions of Zone 8
Shape – Convex
Slope Position – Usually lower slope, but mid and upper slope in inter-moraine situations
Steepness – Moderate to steep
Hydrology – Upland
Fire – Moderately infrequent
Frequency – Uncommon and restricted. Emergent Jeffrey pine is often too sparse to put into this type.

Note, the following similar map units can be confused with this type:

- Singleleaf Pinyon Pine types where Jeffrey pine is too sparse to place into this mapping unit.
- Jeffrey Pine-Curl-leaf Mountain Mahogany Association (3082) – has little or no singleleaf pinyon pine. There is also a moderate to dense canopy of curlleaf mountain mahogany.
- Singleleaf Pinyon Pine/Gummy Gooseberry & Singleleaf Pinyon Pine/Big Sagebrush/Squirreltail Grass Mapping Unit (Superassociation) (3113) – Jeffrey pine is <5% to no cover. Singleleaf pinyon pine may be less dense to 10% cover.
- Singleleaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big Sagebrush–Antelope Bitterbrush Woodland Association (3112) – Jeffrey pine cover is less than 5% to none. Singleleaf pinyon pine and curl-leaf mountain mahogany co-dominate with at least 10% cover of each.
- Singleleaf Pinyon Pine Woodland Alliance (3110) – Jeffrey pine cover is less than 5% to none. Understory shrubs may be sparse to indiscernible.

## 3082 - Jeffrey Pine/Curl-leaf Mountain Mahogany Woodland Association (Zone 8)

***Pinus jeffreyi/Cercocarpus ledifolius* Woodland Association**

During the field reconnaissance seen in several east side canyons, usually in small stands in close proximity to Sierra juniper communities.

Taxa – Sparse to moderately dense emergent Jeffrey pine of at least 5% cover over a rather sparse to dense layer of curl-leaf mountain mahogany. both big sagebrush and antelope bitterbrush are present in the middle and lower shrub layers in varying densities.
Microclimate -
Elevation – Upper portions of Zone 7 extending well into Zone 8 on steep south-facing mid and upper slopes.
Aspect – Generally southerly, can be north-facing in lower elevations
Shape – Always convex
Slope Position – Generally mid to upper slopes
Steepness – Steep
Geology – Seen along shelves mid slope up lateral moraines
Hydrology – Upland
Frequency – Uncommon but seen in canyons

**3082 – Jeffrey Pine/Curl-leaf Mtn. Mahogany Woodland Association**

A eastside woodland type shown here west of Lee Vining about 8500 feet. Note the large rounded crown of the Jeffrey pine and the variable density of the understory curl-leaf mountain mahogany.

Note, the following similar map units can be confused with this type:

- Sierra Juniper/Curl-leaf Mountain Mahogany-(Big Sagebrush) Association (4107) - is usually found in rockier settings.
- Jeffrey Pine/Antelope Bitterbrush Association (3076) – Shrub cover is primarily antelope bitterbrush with some big sagebrush. Little or no curlleaf mountain mahogany. Does not occur at higher elevations.
- Jeffrey Pine-Singleleaf Pinyon Association (3081) – Understory shrub cover is sparse.

Key Photo Signature Notes: Note the presence of curl-leaf mountain mahogany; a large shrub with a distinctive signature (dark brown) against the smaller sagebrush and bitterbrush. Stands where juniper is present should be mapped to type 4107.

## 3083 - Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland Association (Zone 8)

***Pinus jeffreyi-Abies Concolor/Symphiocarpus rotundifolia/Elymus elymoides* Woodland Association**

Noted on the eastside in extensive north trending stands south of Buckeye Creak; more locally elsewhere.

**3083 – Jeffrey Pine – White Fir / Roundleaf Snowberry / Squirreltail Woodland Association**

A relatively mesic eastside type (similar to type 3086 west of the crest). Shown here with Jeffrey pine a dominant in the overstory layer

Taxa – Jeffrey pine and white fir in generally closed to moderately open stands often with a shrub understory with either bush chinquapin or whitethorn ceanothus.
Microclimate – Xeric
Elevation – Upper portion of Zone 8 to lower portion of Zone 7
Aspect – Variable
Shape – Transitional
Slope Position – Mid to lower slopes
Steepness – Slight to moderate
Hydrology – Upland
Frequency – Uncommon, occurs in areas that are not too dry for white fir and not too wet for Jeffrey pine; limited to elevations where Jeffrey pine and white fir occur together.

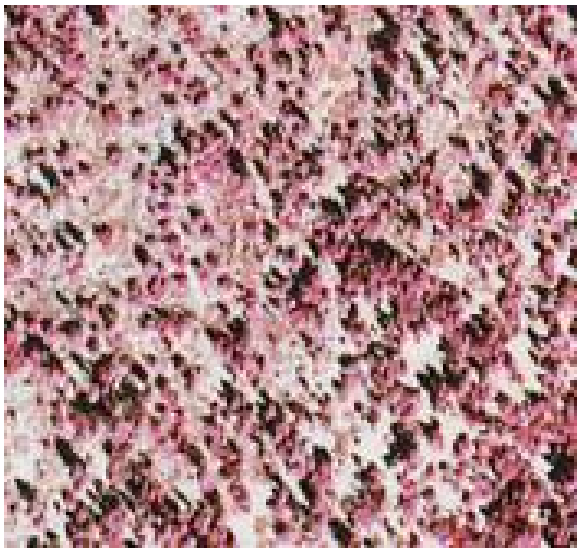
Note, the following similar map units can be confused with this type:

- California Red Fir-White Fir-Jeffrey Pine Association (4072) - is slightly higher in elevation but is not a common eastside type.
- Dense stands of type 3082 are relatively uncommon but contain no white fir.
- Several stands have an influx of Sierra lodgepole pine and make it difficult to delineate
- More mesic areas that contain just white fir

Key Photo Signature Notes: Look for presence of white fir and lack of a shrub understory generally in dense woodland to forest settings. White fir on the eastside also tends to have some die-back to the upper portions of the tree.

## 3084 - Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association (Zone 3)

***Pinus jeffreyi-Quercus chrysolepis/Arctostaphylos viscida* Woodland Association**



**3084 – Jeffrey Pine – Canyon Live Oak / Whiteleaf Manzanita Woodland Association**

A rather dense example just east of Cherry Lake, many stands contain a lot more open rock. Jeffrey pine is the dominant in this scene with the brighter canyon live oak locally patchy over a moderately dense understory of manzanita.

Mapped as fairly extensive polygons generally in the northwestern sections of the park near Hetch Hetchy Reservoir, Cherry Lake and Lake Eleanor in extremely rocky environments.

Taxa - Sparse Jeffrey pine (usually below 10%) with sparse understory of canyon live oak, occasionally California black oak in less steep sites with slightly more soil development. Shrub layer is extremely sparse containing whiteleaf manzanita and usually some greenleaf manzanita. May co-occur with ponderosa pine and incense-cedar where it is impossible to separate.
Microclimate – Lower elevation Jeffrey pine due to rocky environment, usually not cold air drainage
Elevation – 4500 to 5500 feet (generally below Jeffrey pine/greenleaf manzanita association)
Soil – Poorly developed, shallow and patchy
Shape – Convex
Slope Position – Variable
Steepness – Steep and rocky, which often accounts for the presence of canyon live oak and Jeffrey pine and absence of ponderosa pine – not always a reliable criteria.
Geology – Often exposed granitic bedrock with high cover of crustose lichens on rock surfaces and greater than 50% cover of annual herbs on shallow soils
Hydrology – Upland
Frequency – Fairly common and extensive in northwestern portion of the park.

Note, the following similar map units can be confused with this type:

- Jeffrey Pine/Greenleaf Manzanita Association (3072) - does not contain canyon live oak and is generally at higher elevations on less steep slopes.
- Dry ponderosa pine types (3062 or 3053 or 3061) may co-occur or may occupy adjacent sites with a better soil development.
- Gray pine-canyon live oak types at times occur in close proximity to this type and in these settings the two pines are sometimes difficult to distinguish. Gray pine types generally will occupy the significant continuous side slopes at lower elevations.

Key Photo Signature Notes: Environmental parameters are key in distinguishing this type; if they prove unreliable, then it may not be possible to separate this association out except on regional geography (large scale accuracy with small scale error).

## 3085 - Jeffrey Pine-California Red Fir Woodland Association (Zone 4) [Potter]

***Pinus jeffreyi-Abies magnifica* Woodland Association**

**3085 – Jeffrey Pine – California Red Fir Association**

A difficult type to map, this example depicts some large Jeffrey pines in the center. Red fir clearly dominates with about 70-80% of the relative cover.

Observed along Glacier Point Road between 7000 and 7800 feet on open knolls, and along the Tioga Road at somewhat higher elevations – Other conifers often limit the extent of this type from all environments.

Key Photo Signature Notes:
Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 8). Tree cover densities are 17-83% and average 54%.

| | Cons | Cover |
|---|---|---|
| Tree Overstory | | |
| Jeffrey pine | 100 | 26 |
| California red fir | 100 | 30 |
| Tree Understory | | |
| California red fir | 50 | 1 |
| Jeffrey pine | 38 | 2 |
| Shrubs | | |
| Bush chinquapin | 25 | 26 |
| Antelope bitterbrush* | 25 | 1 |
| Forbs | | |
| Pioneer rockcress | 88 | 1 |

* Antelope bitterbrush can be important in east side occurrences

Elevation – 7340-9120 feet, average of 8607 feet, typically above 8500 feet, upper Zone 3 to lower Zone 4
Soil – 38” average
Aspect – SE, SW
Shape – Convex
Slope Position – Upper slopes
Steepness – 12-47%, 33% average
Frequency – Uncommon, restricted by local environmental conditions and elevation

Note, the following similar map units can be confused with this type:

- California Red Fir–White Fir–Jeffrey Pine Association (4072) - is slightly lower, somewhat more mesic and is probably much more common.
- Jeffrey Pine/Huckleberry Oak Association (3075) – usually occur on domes where Jeffrey pine is fairly sparse, with open forest cover and a higher shrub density than 3085.
- California Red Fir Association (4051) – Does not contain Jeffrey pine as a component, and occurs in more mesic environments.

- California Red Fir/Mixed Shrub Mapping Unit (4054) – contains a visible understory of shrubs, whereas 3085 may not.
- California Red Fir-Western White Pine-Sierra Lodgepole Pine (4055) – generally occurs at slightly higher elevations, or somewhat more protected sites and has little or no shrub understory
- California Red Fir-Western White Pine (4057) – is found in the same general area but on a more north trending upper slope.

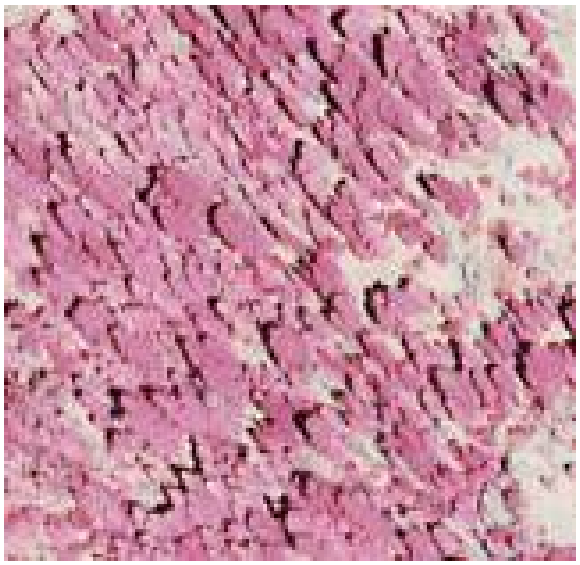
Key Photo Signature Notes: Higher elevations often restrict spatial distribution of Jeffrey pine while other factors (moisture slope) further limit the co-occurrence of the two species to the criteria, which would fit into this association. An extremely difficult type to map.

## 3086 - Jeffrey Pine-White Fir (West Side) & White Fir-Sugar Pine-Jeffrey Pine Superassociation (Zone 3)

***Pinus jeffreyi-Abies Concolor (West Side) & Abies Concolor - Pinus lambertiana - Pinus jeffreyi* Superassociation**

Note: Aggregated to type 4530 in PIFinal field

Observed in the Aspen Valley area just above the meadow at the 6120 foot level, on the Tioga road at 7000 feet, and on the Glacier Point road at about 7100 feet. This type seems to be restricted in elevation due to the presence of California red fir at slightly higher elevations and the absence of Jeffrey pine off the drier sites.



**3086 – Jeffrey Pine – White Fir**

A Westside example, but with no sugar pine in this example; Jeffrey pines have the rounded crown, the white fir the narrow conical crown with some die-back to the tops. Often mapped adjacent to rocky settings in favorable coves.

Taxa – Jeffrey pine and white fir in generally closed to fairly open stands; bush chinquapin or other shrubs may occur in understory in drier stands. Sugar pine may be a component in the canopy.
Microclimate – Xeric
Elevation – Restricted, 5500-6500 feet
Aspect – Variable
Shape – Transitional
Slope Position – Mid to lower slopes
Steepness – Slight to moderate
Hydrology – Upland
Fire – Post-fire response usually includes a decrease in white fir and an increase in whitethorn ceanothus
Frequency – Uncommon, occurs in areas that are not too dry for white fir and not too wet for Jeffrey pine; limited to elevations where Jeffrey pine and white fir occur together.

Note, the following similar map units can be confused with this type:

- California Red Fir-White Fir-Jeffrey Pine Association (4072) - is slightly higher in elevation.
- White Fir-Sugar Pine-California Red Fir Association (4073) - (with Jeffrey pine) usually occupies lower slope positions at slightly higher elevations.
- White Fir – Incense-cedar – Sugar Pine (4094) – is found on more favorable sites with a higher tree density.

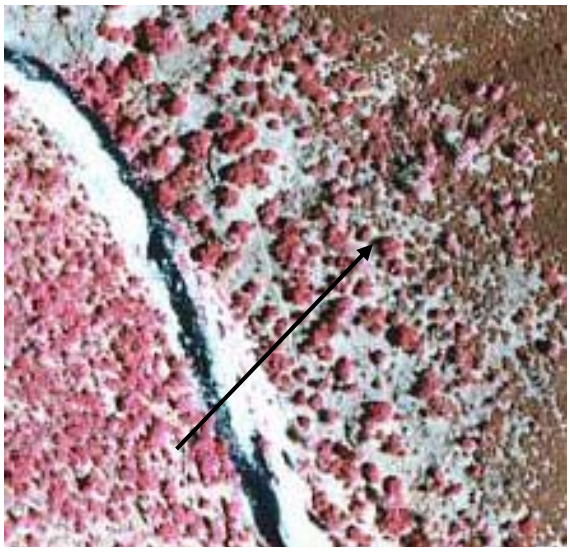
Key Photo Signature Notes: Most samples mapped contain an element of both Jeffrey and sugar pines except in drier settings. Both pines have large crowns, the Jeffrey pine being more rounded, the sugar pine being more star shaped.

## 3090 - Gray Pine Woodland Alliance (Zone 1 & 2)
***Pinus sabiana* Woodland Alliance**

### 3092 - Gray Pine-Interior Live Oak/Whiteleaf Manzanita Association (Zone 1)
***Pinus sabiana – Quercus wislizenii var. wislizeni/ Arctostaphylos viscida* Association**
Note: Aggregated to type 3097 in PIFinal field

Frequently seen throughout most of Zone 1 in dry settings primarily on mid and upper slopes in the El Portal area, and the Cherry Creek road.

Taxa – Sparse stands of gray pine and interior live oak each containing a minimum of 5-10% with a variable shrub layer composed primarily of whiteleaf manzanita.
Microclimate – Xeric
Elevation – Most of Zone 1, more common in the upper elevations
Soil – Poorly developed and rocky in places
Aspect – Southerly
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Moderately steep to steep
Hydrology – Upland
Fire – Will be present within 3 to 5 years of moderate severity fire if gray pines survive fire because live oaks resprout.
Frequency – Common and at times covering fairly extensive areas



**3092 – Gray Pine – Interior Live Oak / Whiteleaf Manzanita Association**
In this example seen east of the river in a open setting with a sparse manzanita understory increasing in density towards the northeast.

Note, the following similar map units can be confused with this type:
- Gray Pine-Interior Live Oak/Buckbrush & Gray Pine-Interior Live Oak/Chamise Superassociation (3095) - probably occurs in slight lower elevations in less rocky settings where gray pine is a sparse emergent associated with dense stands of chaparral.

- Canyon Live Oak-Gray Pine Association (1026) – can be separated out for the most part by elevation and aspect (above 3000 feet).
- Interior Oak – Gray Pine – Blue Oak / Grass contains a fairly dense herbaceous understory with little or no shrub layer.

Key Photo Signature Notes: A steep and rocky low elevation gray pine type; note the presence of the interior live oak (pink signatures) in sparse stands over the whiteleaf manzanita (brown signature).

## 3095 - Gray Pine-Interior Live Oak/Buckbrush & Gray Pine-Interior Live Oak/Chamise Superassociation (Zone 1)

***Pinus sabiana – Quercus wislizenii var. wislizeni/Ceanothus cuneatus & Pinus sabiana – Quercus wislizenii var. wislizeni/Adenostoma fasciculatum* Superassociation**

Note: Aggregated to type 3097 in PIFinal field

**3095 – Gray Pine-Interior Live Oak/Buckbrush & Gray Pine-Interior Live Oak/Chamise Superassociation**

On this example, two distinct stands; one, where gray pine dominates, the other example to the upper left where it is sparse over dense chamise. Interior live oak is a minor and sporadic component to the tree layer.

A few examples of this type were noted in the El Portal area in close proximity to chaparral types on south facing mid slopes.

Taxa – Emergent gray pine (of 3-60%) occurring with generally a very minor component of interior live oak in open to sparse stands with an open to fairly dense shrub understory of buckbrush or chamise.
Microclimate – Xeric
Elevation – Lower portions of Zone 1
Soil – Moderately well developed
Aspect – South to southwest
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Moderately steep to steep
Geology –
Hydrology – Upland
Fire – Occurs within 5 years of a moderate severity fire if pines survive, because live oaks resprout, buckbrush grows rapidly and chamise resprouts and grows very rapidly.
Frequency – Fairly common associated with chaparral areas.

Note, the following similar map units can be confused with this type:

- Gray Pine-Interior Live Oak/Whiteleaf Manzanita Association (3092) - probably occurs on slightly higher elevations (closer to or on ridge tops) on more rocky exposures and contains a sparser shrub understory layer.

Key Photo Signature Notes: Interior live oak often plays an insignificant role in this association; gray pine (pink signature) against a usually dense (smooth brown) non-manzanita chaparral is the typical setting. Gray pine varies in crown density, often within the stand.

## 3096 - Gray Pine/Whiteleaf Manzanita Association (Zone 1 & 2)

***Pinus sabiana/ Arctostaphylos viscida* Association**

Note: Aggregated to type 3097 in PIFinal field

Taxa – Gray pine occurring in extremely sparse settings (3-10%) over a generally sparse whiteleaf manzanita shrub understory (3-40%) containing a sparse herbaceous layer over rock.
Microclimate – Xeric
Elevation – 1500 - 4000
Soil – Minimal
Aspect – Variable
Shape – Neutral to convex
Slope Position – Low to upper
Hydrology – Upland
Frequency –

Note, the following similar map units can be confused with this type:

- Gray pine types with canyon or interior oak generally contain a higher tree density and shrub layer.

**3096 – Gray Pine / Whiteleaf Manzanita Association**

Mapped here with a minor component of canyon live oak throughout the photo just north of Hetch Hetchy Reservoir. Sparse gray pine (pink rounded crown) over a sparse manzanita layer (brownish shrub against the rock outcropping) is the typical setting.

Key Photo Signature Notes: The key element to note in this type is the near or complete absence of any oak in the tree layer. This is a sever rocky type ranging in elevation from where interior oaks occur to where canyon live oaks would occur in more favorable settings.

## 3097 - Gray Pine-Interior Live Oak/(Whiteleaf Manzanita-Buckbrush-Chamise) Woodland Superassociation

***Pinus sabiana – Quercus wislizenii var. wislizeni/(Arctostaphylos viscida- Ceanothus cuneatus-Adenostoma fasciculatum)* Woodland Superassociation**

Note: Aggregation type including original PI Codes 3092, 3095 & 3096

Generally a sparse woodland aggregation of several xeric gray pine types.

Taxa – Gray pine dominates the canopy as a sparse cover; occasionally with a co-dominance of either Interior or in higher elevations, canyon live oak. Lowest elevations tend to contain an understory of chamise and/or buckbrush.

Microclimate – Xeric
Elevation – Throughout zone 1
Aspect – Variable
Shape – Variable
Slope Position – Mid to Upper
Steepness – Moderately steep to steep
Geology –
Hydrology – Upland
Fire –
Frequency – Fairly commonly mapped aggregated type

Note, the following similar map units can be confused with this type:

- Lower elevation Ponderosa or Jeffrey pine types with a live oak component in an open setting.

Key Photo Signature Notes: This is an aggregated type where gray pine dominates the canopy, usually in very sparse settings. gray pines generally yield the least amount of CIR of any of the conifers and often show up a very light pink on the photography. Ponderosa and Jeffrey pines, which may occur in adjacent stands also, yield a very light signature in these dry settings but usually have a larger more rounded crown.

## 3100 - Knobcone Pine Woodland Alliance (Zones 1 & 2)

***Pinus attenuata* Woodland Alliance**

### 3101 - Knobcone Pine/Whiteleaf Manzanita Woodland Association (Zone 1)

***Pinus attenuata/ Arctostaphylos viscida* Woodland Association**

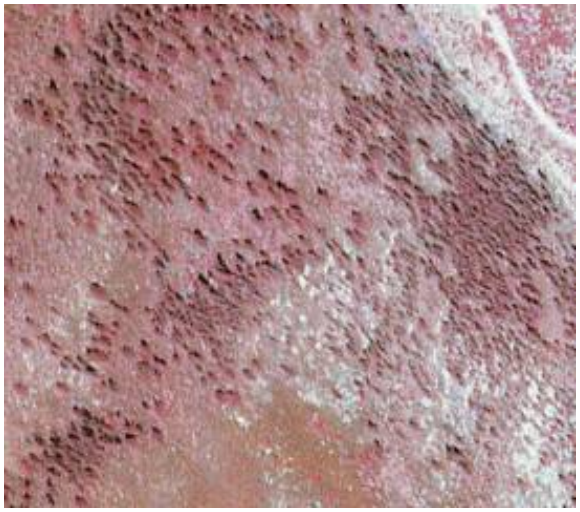
Several small examples noted in a post burn situation within the Arch Rock Burn of 1990. This stand was observed in association with ponderosa pine, whiteleaf manzanita, deerbrush and mountain misery. Most trees were less than 15 feet tall. Most stands contain no ponderosa pine.

Taxa – Knobcone pine in extremely sparse to moderately closed stands at times in association with ponderosa pine. Whiteleaf manzanita is a common shrub occurring often in dense stands. Where whiteleaf manzanita stands are more open, mountain misery may become an extensive ground cover. Note that knobcone pine is an extreme example of an indicator species (several trees of 1-3% cover would be worth converting the mapping unit to this type)
Microclimate – Xeric to dry mesic
Elevation – Mostly upper most portions of Zone 1, and south to southwest exposures of Zone 2.
Soil – Moderately well developed
Aspect – Highly variable
Shape – Highly Variable
Slope Position – Upper slopes and ridgetops
Steepness – Moderately steep
Hydrology – Upland

Fire – Increased in the Foresta area following 1990 A-Rock fire
Frequency – Uncommon and restricted in size mostly west and south of the Cedar Lodge

Note, the following similar map units can be confused with this type:

- It is not possible to distinguish areas within the Arch Rock burn (1990) that contain ponderosa pine/whiteleaf manzanita association (3053) from knobcone pine/whiteleaf manzanita association at this stand age of approximately 9 years. It may be worthwhile to mention the presence of whiteleaf manzanita in the burn polygons that are classified as a burned example of a ponderosa pine/whiteleaf manzanita association.
- Knobcone pine/chamise stands may occur down slope a ways from this type.



**3101 = Knobcone Pine / Whiteleaf Manzanita Woodland Association**

Narrow crowns, variable cover and dense manzanita understory typifies these stands. Note chamise components in lower portion of photo.

Key Photo Signature Notes: Generally the chaparral (chamise) understory yields a smoother and more even signature tone than whiteleaf manzanita.

## 3102 - Knobcone Pine-Canyon Live Oak Woodland Mapping Unit (Zone 1)

***Pinus attenuata Pinus ponderosa- Quercus chrysolepis* Woodland Mapping Unit**

One example of this type was observed at the uppermost slopes south of Cedar Lodge on the South Fork Trail.

Taxa – Sparse to extremely sparse emergent stands of knobcone pine from 1-10% over a dense understory tree layer of canyon live oak over 75%.
Microclimate – Dry mesic
Elevation – Upper portions of Zone 1
Soil – Well developed
Aspect – Northerly

Shape – Slightly concave
Slope Position – Uppermost slopes to near ridge top
Steepness - Moderately steep
Geology –
Hydrology – Upland
Fire – Will convert to knobcone pine alliance following stand-replacing fire.
Frequency – Extremely rare

Note, the following similar map units can be confused with this type:

- Emergent stands of gray pine over chaparral and or canyon live oak may be extremely difficult to distinguish from knobcone pine. Knobcone pine tends to have a more erect crown and a darker green color, and occur on upper most slopes and ridge tops.

Key Photo Signature Notes: This type may be transitional between a canyon live oak type and a drier knobcone / chaparral type.

**3102 – Knobcone Pine-Canyon Live Oak Woodland Mapping Unit**

This particular example has a dense cover of canyon live oak with a sparse knobcone pine emergent. It is an upper slope site where mesic canyon live oak is found down slope (upper most portion of the image) and a narrow band of manzanita is noted along the ridge top.

## 3105 - Knobcone Pine/Chamise Woodland Association (Zone 1)

***Pinus attenuata/Adenostoma fasciculatum* Woodland Association**

Taxa – Knobcone pine as a sparse emergent to chamise.
Microclimate – Xeric
Elevation – Zone 1
Soil – Poorly developed soil, rocky
Aspect – Southerly
Shape – Convex
Slope Position – Upper slopes and ridgetops
Steepness – Steep on upper slopes, shallower slopes on ridgetops
Geology – Granitic
Hydrology – Upland
Fire – Smaller-statured knobcone pine (from seeds) and resprouting chamise following stand-replacing fires; fires are typically stand-replacing in this type.

Frequency – Rare
Note, the following similar map units can be confused with this type:

- Knobcone Pine/Whiteleaf Manzanita Association (3101) – is probably more common and more often found on ridgetops.

Key Photo Signature Notes: Note the smoother signature of the understory chamise in comparison to the whiteleaf manzanita.

**3105 – Knobcone Pine / Chamise Woodland Association**

This example has a significant component of whiteleaf manzanita (pinker shrub) but has a slightly higher relative dominance of chamise. May not be distinguishable from type 3101.

## 3110 - Singleleaf Pinyon Woodland Alliance (Zone 8)

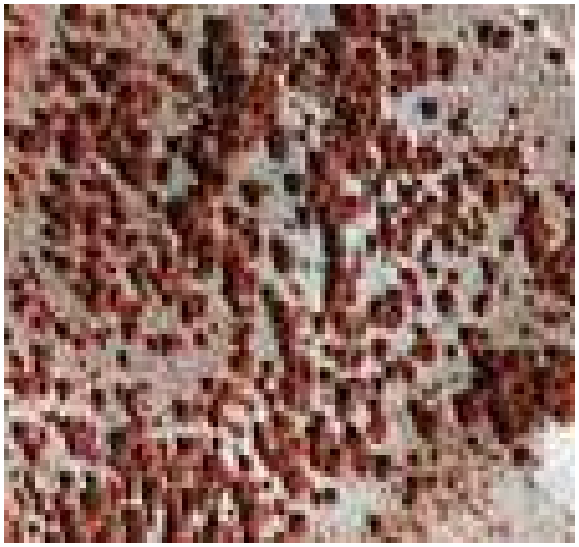
***Pinus monophylla* Woodland Alliance**

### 3112 - Singleleaf Pinyon-Curl-leaf Mountain Mahogany/Big Sagebrush Antelope Bitterbrush Woodland Association (Zone 8)

***Pinus monophylla/Cercocarpus ledifolius-Artemisia tridentata- Purshia tridentata* Woodland Association**

In most circumstances during the field reconnaissance singleleaf pinyon pine and curl-leaf mountain mahogany were independent of each other. However, occasionally they did mix. Most examples were seen along US 395 north of Lee Vining and in the lower portions of Lee Vining Canyon on north facing slopes.

Taxa – Singleleaf pinyon pine and curl-leaf mountain mahogany co-dominate (may be complexing below MMU) with at least 10% relative cover of either species in fairly dense stands.
Microclimate – Xeric
Elevation – Mid to upper portions of Zone 8
Aspect – Generally north-facing
Slope Position – Mid to upper slopes
Steepness – Moderately steep to steep
Hydrology – Upland
Frequency – Uncommon or rare, the two species are however many times in close proximity to each other



**3112 = Singleleaf Pinyon - Curl-leaf Mountain Mahogany**

Occurring on somewhat steeper and rockier settings than type 3113, this example shows the pinyon pine (pinker signature) as a sparse overstory to a somewhat denser curl-leaf mountain mahogany shrub layer.

Note, the following similar map units can be confused with this type:

- Singleleaf Pinyon/Ribes Velutinum & Singleleaf Pinyon/Big Sagebrush-Antelope Bitterbrush Superassociation (3113) – stands where curl-leaf mountain mahogany is a sparse component to the singleleaf pinyon.
- Curl-leaf Mountain Mahogany Alliance (5230) – stands where singleleaf pinyon is a sparse component to the curl-leaf mountain mahogany.
- Sierra Juniper/Curl-leaf Mountain Mahogany/Big Sagebrush Woodland - generally found at slightly higher elevations in rockier steeper settings

Key Photo Signature Notes: These two species do not often mix except in small areas and could be considered transitional areas.

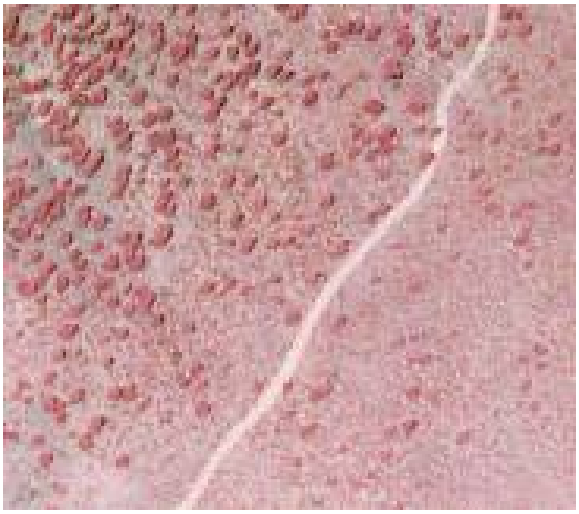
## 3113 - Singleleaf Pinyon/(Desert Gooseberry-Big Sagebrush/Squirreltail) Woodland Superassociation (Zone 8)

***Pinus monophylla/(Ribes velutinum-Artemisia tridentata- Elymus elymoides* )Woodland Superassociation**

Observed throughout the lower elevations during the field reconnaissance, especially in the Lee Vining Canyon and south of the Bridgeport Meadows.

Taxa – Singleleaf pinyon in sparse to moderately dense stands of at least 5-10% cover, visible shrub component in the understory layer containing big sagebrush, antelope bitterbrush, and desert gooseberry in varying densities. Indian ricegrass is an indicator species but may not be present in all circumstances.

Microclimate – Note that in the Bridgeport Valley cold air drainage prevents singleleaf pinyons from descending to the lowest slopes. It is doubtful if this is moisture-related, since the town of Bridgeport receives 10” precipitation annually, generally adequate for singleleaf pinyon.



**3113 – Singleleaf Pinyon/(Desert Gooseberry-Big Sagebrush/Squirreltail) Woodland Superassociation**

Depicted here in its range of densities, pinyon pine forms an open to moderately dense woodland over a variety of shrubs depending on slope characteristics.

Elevation – Generally the lower portions of Zone 8
Slope Position – All slopes, mainly foothills
Steepness – Slight to steep
Hydrology – Upland
Frequency – Very common, mapping units often extensive

Note, the following similar map units can be confused with this type:

- Singleleaf Pinyon-Curl-leaf Mountain Mahogany/Big Sagebrush-Antelope Bitterbrush Association (3112) - has a curl-leaf mountain mahogany component.

Key Photo Signature Notes: This is the lowest elevation eastside conifer type, several examples may contain Utah juniper along the eastern boundary of the study. Pinyon pine varies a lot in stand density and crown size.

## 3130 - Western White Pine Woodland Alliance (Zones 4 & 7)

***Pinus monticola* Woodland Alliance**

Note: Although still in classification as a place holder, aggregated to type 3131 in PIFinal field

### 3131 - Western White Pine/Western Needlegrass Woodland Mapping Unit (Zone 4)

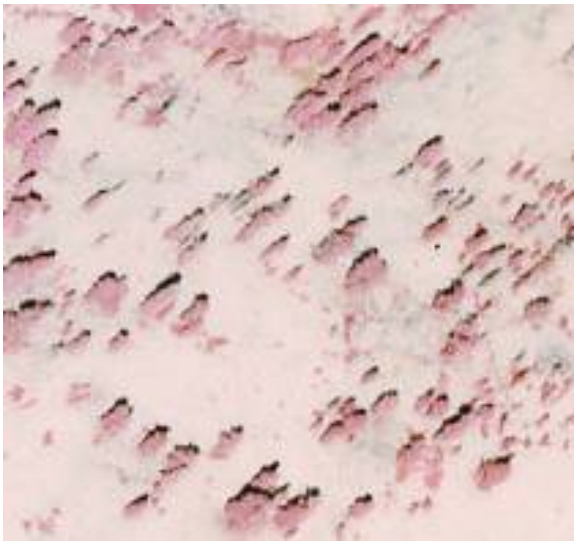
***Pinus monticola/Achnatherum occidentale* spp. Woodland Mapping Unit**

Note: Aggregation type including original PI Code 3130

Taxa – Western white pine in moderately open stands with little or no associated conifers present. Understory grasses (western needlegrass) is an indicator species only and need not be present.
Microclimate – Exposed to severe wind
Elevation – 8000–9600 feet, upper slopes and ridges, Zone 4
Soil – Shallow
Shape – Convex
Slope Position – Upper slopes and ridgelines
Steepness – Moderate to steep
Hydrology – Upland
Frequency – Fairly common but usually restricted to upper slopes and narrow ridges

Note, the following similar map units can be confused with this type:

- Western White Pine–Sierra Lodgepole Pine Association (3132) - will usually be found in lower slope positions.
- California Red Fir-Western White Pine Association (4057) – is usually more mesic, with a denser canopy, significant California red fir component, often on steep mid to upper slopes just below ridgelines.
- California Red Fir-Western White Pine-Sierra Lodgepole Pine Association (4055) – is usually more mesic, with a denser canopy, significant California red fir component, on lower slopes, and slightly lower in elevation.
- California Red Fir-Western White Pine & California Red Fir-Western White Pine-Sierra Lodgepole Pine Superassociation (4062) – is usually more mesic, with a denser canopy, significant California red fir component, on lower slopes, and slightly lower in elevation.
- California Red Fir-Western White Pine/Mixed Shrub Superassociation (4069) – is also a dry open woodland but is found on hotter, drier sites always downslope from 3131 and often in transition to Jeffrey pine types.



**3131 - Western White Pine/Western Needlegrass Woodland Mapping Unit**

An open woodland in this example composing of over 90% cover of white pine. Several Sierra lodgepole pine are scattered throughout the stand.

Key Photo Signature Notes: Looked for crown shape of the western white pine (irregular and diffuse), smaller individuals stunted by wind and cold are often difficult to distinguish from Sierra lodgepole pine.

## 3132 - Western White Pine-Sierra Lodgepole Pine Association (Zones 4 & 7)

***Pinus monticola-Pinus contorta var. murrayana* Association**

Note: Aggregated to type 4510 in PIFinal field

(Zone 4 & 7)
Observed on the road to May Lake at the 8700 feet, and at Glacier Point at 7800 feet. Noted near Siesta Lake above 8000 feet. Also occurs along the eastern end of Buena Vista Crest.
Taxa – Western white pine and Sierra lodgepole pine occurring in moderately open stands with at least 10% relative cover of each species.
Microclimate – Xeric
Elevation – 7800-9600 feet (generally the range of western white pine)
Aspect – Variable
Shape – Variable, but rarely extremely concave or convex

**3132 = Western White Pine – Sierra Lodgepole Pine Association**

Occurring in a wide range of settings and stand densities; this particular example is lodgepole dominant with about 25% relative cover of western white pine.

Slope Position – Mid to upper slopes
Steepness – Moderate, not as steep as other western white pine types but steeper than adjacent dry Sierra lodgepole pine types
Hydrology – Upland
Frequency – One of the more common types containing western white pine

Note, the following similar map units can be confused with this type:

- Western White Pine/Western Needlegrass Association (3131) - is upslope from 3132.
- California Red Fir–Western White Pine–Sierra Lodgepole Pine Association (4055) - is generally found downslope from 3132, lower in elevation, and contains a significant California red fir component.
- Sierra Lodgepole Pine/Woodland Association (3038) – has little or no western white pine, is found on less severe slopes and lower slope positions.
- Sierra Lodgepole Pine/Mountain Pride Association (3021) – has an extremely sparse canopy cover and is usually found at a higher elevations, but on gentler terrain.
- Mountain hemlock – Sierra lodgepole pine – western white pine (4043) is often adjacent to this type usually in nearby coves or shady slopes.
- California Red Fir – Western White Pine/Mixed Shrub (4069) - Several examples of Sierra lodgepole pine-western white pine were noted with an understory of shrubs (huckleberry oak & bush chinquapin) without any California red fir.

## 3140 - Whitebark Pine Woodland Alliance (Zones 4, 5 & 7)

***Pinus albicaulis* Woodland Alliance**

Taxa – Whitebark pine dominates in sparse to dense stands sometimes with a very sparse shrub layer that may include *Ribes montigenum* (at lower elevations) or *Ribes cereum* (near treeline). May form weathered stands on exposed sites with stunted vegetation. Sierra lodgepole pine may be present in low abundance.
Microclimate – Xeric to Submesic
Elevation – Upper portions of zone 4, zones 5, 6, and upper portions of 7; 8500 to 13,500 ft.
Soil – Rocky
Aspect – Variable
Shape – Variable
Slope Position – Middle and upper slopes to ridges
Steepness – Level to very steep
Geology – Talus and scree slopes, well drained, poorly developed soils at high elevation
Hydrology – Upland

Fire – Infrequent
Frequency – Frequent near treeline in the upper portion of zone 4

Note, the following similar map units can be confused with this type:

- High elevation Sierra lodgepole pine types with a component of whitebark pine

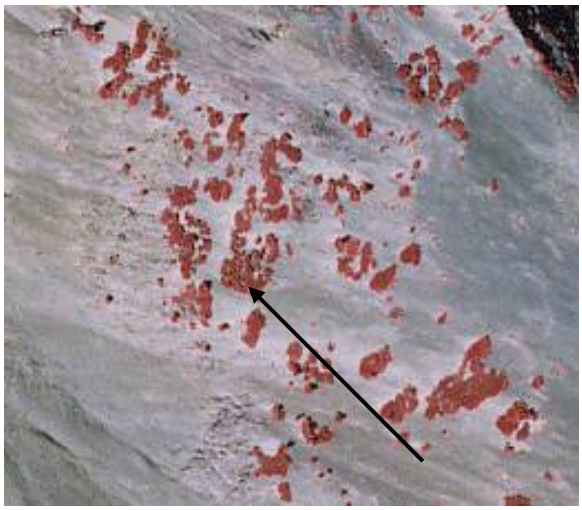
## 3142 - Whitebark Pine/Davidson Penstemon Association (Zones 4, 5 & 7)

***Pinus albicaulis/Penstemon davidsonii* Woodland Association**

Note: Aggregated to type 3149 in PIFinal field

Noted during the field reconnaissance on the highest slopes above 10,000 feet, up to 12,000 feet on south-facing slopes. Mapped where only isolated stems are emergent to the dominant form, which is a mat forming-shrub. Also observed south of the Tioga Road near the east entrance of the park near Gaylor Peak at about 11,000 feet. Davidson penstemon was noted in many stands. Only isolated stems of whitebark pine were emergent to the dominant form, which is a prostrate tree.

Taxa – Sparse to dense stands of krummholz whitebark pine. May include some sub-krummholz stands where slopes are rocky and steep.
Microclimate – Probably warmest monthly mean is below 50° F (10°C)
Elevation – 10,000 to 12,000 feet, Zone 4 and 7; locally to 9000 feet (rare) on exposed ridges
Soil – Rocky, shallow soil development
Aspect – Variable depending on elevation
Shape – Variable, usually convex
Slope Position – Upper slopes and summits
Steepness – Highly variable
Geology – Granitic and metamorphic
Hydrology – Upland
Fire – Infrequent to rare
Frequency – Common and extensive on the west side, common in highest elevations on east side just below the tree line



**3142 = Whitebark Pine / Davidson Penstemon Association**

The highest elevation woodland; whitebark pine in this association is usually a shrub; stand density varies considerably.

Note, the following similar map units can be confused with this type:

- Lower expressions of whitebark pine where type 3142 individuals are not yet stunted or sheared by wind and low summer temperatures

- Whitebark Pine/Wheeler Bluegrass Association & Whitebark Pine/Ross Sedge Superassociation (3146) – can have denser canopy cover dominated by upright trees (not krummholz) on deeper soils. Occurs at lower elevations than whitebark pine/Davidson penstemon association, and is on moderate slopes that are not as rocky.
- Whitebark Pine–Mountain Hemlock Association (3148) – contains a mountain hemlock component and is found on steep north slopes.
- Whitebark Pine/Shorthair Sedge Association (3144) – is less rocky and often occurs adjacent to meadows. Shorthair sedge usually visible on the aerial photography.

Key Photo Signature Notes: At times may be confused with the slightly brighter stands of Sierra Willow, which will usually have small rivulets running through the stand.

## 3143 - Whitebark Pine/(Ross Sedge-Shorthair Sedge) Woodland Superassociation (Zones 4 & 5)

***Pinus albicaulis*/(*Carex rossii-Carex exserta*) Woodland Superassociation**

Note: Aggregation type including original PI Codes 3144 & 3146

A lower elevation whitebark pine aggregation where whitebark pines often attain full stature. Found in meadow like settings and drier woodlands.

Taxa – Whitebark pine is the sole dominant to the conifer overstory in sparse to moderately dense cover. Higher elevation meadow settings tend to favor an understory of shorthair sedge, while denser woodlands in somewhat drier settings tend to have a sparse understory of Ross sedge.
Microclimate – Submesic
Elevation – Upper elevations of zone 4 and 7; throughout zone 5
Aspect – Variable
Shape – Neutral to convex
Slope Position – Low to Upper
Steepness – Level to moderately steep
Hydrology – Upland
Frequency – Fairly commonly mapped aggregated type

Note, the following similar map units can be confused with this type:

- High elevation Sierra lodgepole pine types with a component of whitebark pine
- Krummholzing whitebark pine stands

Key Photo Signature Notes: This is an aggregated type of generally full stature or partially krummholzing trees. Settings vary from meadow like to a dry sparse herbaceous understory where Ross sedge is inferred in the understory. Usually, shorthair sedge is the dominant herbaceous species in stands where meadows are frequent in open conifer settings. Shorthair sedge is generally recognizable on the aerial photography in late season growth as a stressed plant, showing yellowish to cream colored appearance.

## 3144 - Whitebark Pine/Shorthair Sedge Association (Zones 4 & 5)

***Pinus albicaulis/Carex exserta* Association**

Note: Aggregated to type 3143 in PIFinal field

Observed at high elevations as partially krummholzed stands in concave settings where some soil development occurs between the glacial scree. Shorthair sedge was noted in these areas with the whitebark pine, usually adjacent to rocky convex areas where the whitebark pine/Davidson penstemon association was seen.

Taxa – Whitebark pine in sparse to moderate stands, not always but can be partially to totally prostrate, with a moderate to dense herbaceous cover of shorthair sedge.
Microclimate – Impressive "reverse topography" settings where whitebark pine dominates cold lake basins and a mix or lodgepole environment is noted upslope
Elevation – Above 10,500 feet, Zone 4
Soil – Minimal but more than the whitebark pine/Davidson penstemon association
Aspect – Variable
Shape – Concave
Slope Position -
Steepness – Moderate upper slopes
Geology – Glacial scree
Hydrology – Temporarily saturated - some moisture accumulation in concave areas
Frequency – Common, mapping units vary in size

**3144 – Whitebark Pine / Shorthair Sedge Association**

A dry meadow - woodland type, depicted here with some wet meadow in the lower portion of the photo. Sedge shows up as a brown to cream color. This type often occurs in a partially krumholzed structure.

Note, the following similar map units can be confused with this type:

- Whitebark Pine/Wheeler Bluegrass & Whitebark Pine/Ross Sedge Superassociation (3146) – generally occurs in drier settings with less soil development. Trees are less stunted also.
- Whitebark Pine/Davidson Penstemon Association (3142) – is rockier and occurs on convex slopes. Shorthair sedge is usually visible on the aerial photography.
- Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge (3043) is found in similar settings at lower elevations.

Key Photo Signature Notes: Stands are often adjacent to wetter meadows or mesic rock outcroppings or glacial scree.

## 3146 - Whitebark Pine/Wheeler Bluegrass & Whitebark Pine/Ross Sedge Superassociation

***Pinus albicaulis/Poa & Pinus albicaulis/Carex rossii* Superassociation**

Note: Aggregated to type 3143 in PIFinal field

Taxa – Whitebark pine in stands varying in densities from 10 to 60% cover.
Herbaceous cover is usually below 25%, consisting of either Ross sedge or Wheeler bluegrass. Whitebark pine may sometimes have sub-krummholz form in areas with some soil development and not as rocky as type 3142.
Microclimate – Below true krummholz zone where mean warm month temperature is below 50 ° F (10°C)
Elevation – 9500 to 10,000 feet in Zone 4 and 10,000 to 11,000 feet in Zone 7
Aspect – Variable, depending on elevation
Shape – Variable, generally convex
Slope Position – Upper slopes and ridge tops
Steepness – Generally moderate to steep
Hydrology – Upland

**3146 – Whitebark Pine / Ross Sedge**

A high elevation dry whitebark type (below krumholz line) where stand density varies considerably. In this example; type 3146 transitions to type 3142 towards the upper portion of the image.

Note, the following similar map units can be confused with this type:

- Sierra Lodgepole Pine–Whitebark Pine/Ross Sedge Association (3033) - (where the two conifers mix) occurs at slightly lower elevations. Since the two conifers are in some cases difficult to discern on aerial photography (e.g. whitebark pine without multiple trunks or “flat tops”) getting a good break between the two types may be difficult.
- Whitebark Pine/Davidson Penstemon Association (3142) – can have sparser canopy cover, occurs at higher elevations, and is on steeper slopes. At lower elevations where type 3142 stands are not krummholz, area may be very rocky and steep.
- Whitebark Pine/Shorthair Sedge Association (3144) – is somewhat more mesic, often adjacent to meadows.

- Whitebark Pine-Mountain Hemlock Association (3148) – Contains a mountain hemlock component, and is found in areas of longer season snow cover.

Key Photo Signature Notes: Crown shape is generally a good indicator with this type since whitebark pines are often full stature trees.

### 3147 - Whitebark Pine – Mountain Hemlock Woodland Association (Zones 4, 5 & 7)

***Pinus albicaulis– Tsuga mertensiana* Woodland Association**

Note: Aggregation type including original PI Codes 3148 & 4042

Taxa – Whitebark pine or mountain hemlock dominate or co-dominate the conifer cover in small stands. Sierra lodgepole pine may be a subordinate to the stand.
Microclimate –Submesic (late season snow patches)
Elevation – Upper elevations of zone 4 & 7, much of zone 5
Aspect – Northerly
Shape – Neutral to concave
Slope Position –Upper slopes
Steepness – Very steep
Hydrology – Upland
Frequency – Uncommon aggregate and limited in stand size

Note, the following similar map units can be confused with this type:

- High elevation stands of whitebark pine on steep slopes

Key Photo Signature Notes: Aggregation of two mapped phases. Difficult to distinguish conifers apart due to small stand size, small stature of trees and steep slopes

### 3148 - Whitebark Pine–Mountain Hemlock Association (Zones 4, 5 & 7)

***Pinus albicaulis-Tsuga mertensiana* Association**

Note: Aggregated to type 3147 in PIFinal field

Observed during the field reconnaissance in steep northerly settings transitional to the drier and colder whitebark pine stands and the snowier settings that promote pure stands of mountain hemlock. Less commonly observed than the co-dominance of western white pine and mountain hemlock.

Taxa – Sparse to moderately dense stands of whitebark pine and mountain hemlock with at least 10% relative cover for each species.
Microclimate – Less snow but possibly colder than areas containing pure mountain hemlock
Elevation – Upper portions of Zones 4 and 7
Aspect – Northerly

Shape – Concave to neutral
Slope Position – Upper slopes
Steepness – Steep
Hydrology – Upland
Frequency – Fairly common but often restricted in size

**3148 = Whitebark Pine – Mountain Hemlock Association**

The highest type where hemlock is a co-dominant, in this example dominates over whitebark pine in a steep rocky environment.

Note, the following similar map units can be confused with this type:

- This type and many of the high elevation conifer types are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold. Therefore, several of the east side high elevation conifers can occur as complex units below the MMU. Severe cold often distorts the normal growth form of these conifers, making it difficult to separate out individual trees in some circumstances. This is especially true in shady steep north exposures.
- Mountain Hemlock/Pioneer Rockcress Association (4032) – does not contain whitebark pine, but does contain western white pine and California red fir, and is generally found at lower elevations.
- Mountain Hemlock–Western White Pine Association (4033) – does not contain whitebark pine, and is found at lower elevations.
- Whitebark Pine/Wheeler Bluegrass & Whitebark Pine/Ross Sedge Superassociation (3146) – does not contain a mountain hemlock component.
- Whitebark Pine/Davidson Penstemon Association (3142) – does not contain mountain hemlock, is on steep rocky upper slopes and has a sparser canopy cover.
- Mountain Hemlock-Sierra Lodgepole Pine-Whitebark Pine Association (4042) – contains a component of lodgepole pine, is found at slightly lower elevations and is not a steep as 3148.

## 3149 - Whitebark Pine-(Sierra Lodgepole Pine-Mountain Hemlock) Krummholz Conifer Mapping Unit (Zones 4, 5 & 7)

***Pinus albicaulis-(Pinus contorta var. murrayana – Tsuga mertensiana)* Krummholz Conifer Mapping Unit**

Note: Aggregation type including original PI Code 3142 but allows for other stunted conifer species.

A high elevation conifer aggregated type of predominantly krummholzing trees.

Taxa – Whitebark pine usually dominates the stand except in unique situations where stunted Sierra lodgepole pines may replace whitebark pine on lower elevation ridgelines and summits (often noted in the 8000-9500’ range). On steep north trending upper slopes, whitebark pine may

share dominance with stunted mountain hemlock. Understory herbaceous layer is generally very sparse.
Microclimate – Xeric to Submesic
Elevation – 8500 to 13500 feet
Aspect – Variable
Shape – Variable
Slope Position –Upper slopes, ridges and summits.
Steepness – Level to very steep
Hydrology – Upland
Frequency – Very common and extensively mapped aggregated type of high elevations

Note, the following similar map units can be confused with this type:

- High elevation stands of stunted Sierra juniper
- High elevation stands of stunted limber pine

Key Photo Signature Notes: This is an aggregated type where occasionally conifer species other than whitebark pine grow in stunted forms making it impossible for the photointerpreter to distinguish. Nearly all mapped polygons are probably keyed to type 3142 where shrubby whitebark pines grow on talus and scree like settings.

## 3150 - Limber Pine Woodland Alliance (Zones 4 & 7)

***Pinus flexilis* Woodland Alliance**

Note: Mapped only in a few east side locations (37 polygons). AA data not generated for this type.

Taxa – Limber pine dominates the stand; may share cover with whitebark pine. Several of the mapped stands are fairly extensive.
Microclimate – Xeric
Elevation – Zone 7 – upper elevations
Aspect – Mapped stands trend northerly
Shape – Neutral to convex
Slope Position –Upper slopes.
Steepness – Very steep
Geology – Granitic and Metasedimentary rocks undivided
Hydrology – Upland
Fire – Fire is likely to be an infrequent process in these stands
Frequency – Rare in the study area

Note, the following similar map units can be confused with this type:

- High elevation stands of stunted Sierra juniper
- Lower elevation drier east side

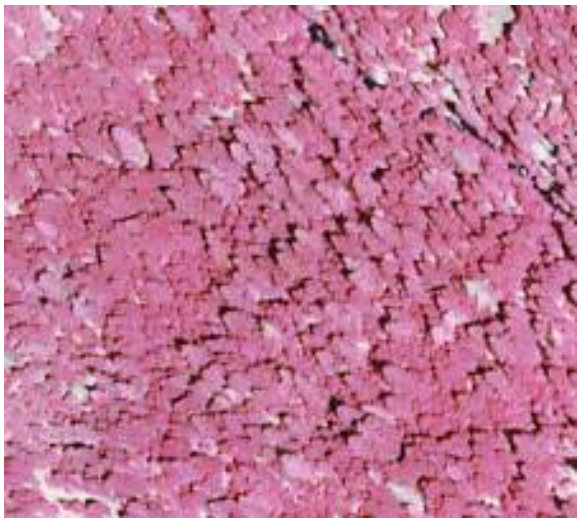
whitebark pine.

Key Photo Signature Notes: Most of the mapped stands are stressed or dying from white pine blister rust and other stressors and show up on the photography as dead or dying conifers.

# 4000 - Needleleaf Conical-form Trees

## 4010 - Douglas-fir Forest Alliance (Zone 2)
***Pseudotsuga menziesii* Alliance**

### 4011 - Douglas-fir-White Fir Forest Association (Zone 2)
***Pseudotsuga menziesii – Abies concolor* Association**
Note: Aggregated to type 4550 in PIFinal field



**4011 – Douglas-fir-White Fir Forest Association**

An example taken near Harden Lake; this stand is an even mix of the two species; the Douglas-fir is the darker tree; note some die back in the white fir.

A relatively uncommon example within the Douglas-fir alliance at Yosemite, requiring highly defined physical parameters to sustain this type. Noted in two areas; the southern edge of the Yosemite Valley, and on isolated areas on steep north facing slopes south of the Hetch Hetchy Reservoir. Elevations must be low enough to allow Douglas-fir to exist, and must be shielded by steep canyon walls to be cool enough for white fir. Sites are extremely restricted, and ecotonal edges are sharp often with encroaching canyon live oak.

Taxa – Douglas-fir in moderately closed to closed stands with white fir a secondary component of at least 5%. Douglas-fir and white fir together compose well over half of the conifers. Tree crown cover is at least 40-60%. Drier/warmer tree species encroaching from all directions (canyon live oak from the canyon side slopes receiving more sunlight, and ponderosa pine, incense-cedar, and California black oak from the lower valley slopes further away from the shade effects of the steep canyon walls). May contain a component of sugar pine.
Microclimate – Mesic, cold air drainage effects are an important factor
Elevation – Zone 2 above 4000 feet to 5000 feet, limited to Zone 2
Soil – Generally rocky with local soil development between large boulders
Aspect – North to northeast
Shape – Concave
Slope Position – Lower slopes, base of cliffs, shadow of steep cliffs
Steepness – Steep to extremely steep
Geology – Glacial debris or till
Hydrology – Upland
Fire – Not a fire-following type. Fire return interval less than 5 to 25 years at YOSE.
Frequency – Rare and extremely localized by environmental conditions

Note, the following similar map units can be confused with this type:

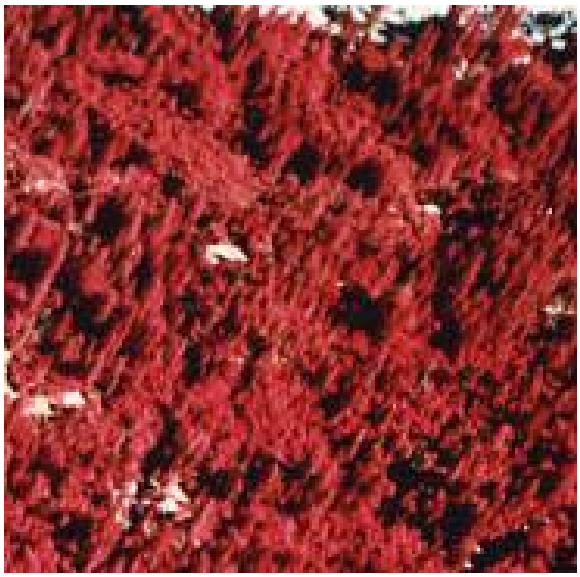
- Douglas-fir-Canyon Live Oak Association (4012) - on rockier more convex sites, and on higher slopes.

- Ponderosa Pine-Incense-cedar-Black Oak Association (3063) - (with a minor Douglas-fir component) severely restricts the downward development of this type.
- Overall this type can be difficult to map due to extreme shadowing on the photography.
- White Fir-Sugar Pine-Incense-cedar Superassociation (4094) – is found upslope from 4011 and at higher elevations.

Key Photo Signature Notes: Note the very dark magenta signature where Douglas-fir occurs and the die-back to white fir trees.

## 4012 - Douglas-fir-Canyon Live Oak Forest Association (Zone 2)

***Pseudotsuga menziesii-Quercus chrysolepis* Forest Association**



**4012 – Douglas-fir – Canyon Live Oak Association**

Limited in extent, this example is on a steep northerly setting above the Merced River.

Observed in two regions of the park over a somewhat more extensive setting than the Douglas-fir-white fir association. Restricted to steep canyons along the Yosemite Valley and north-facing slopes above the Hetch Hetchy Reservoir.

Taxa – Douglas-fir of minimum 2-5% cover to approximately 30%, generally as a sparse emergent to dense stands (70-95% cover) of canyon live oak. California bay often associated with dense stands of canyon live oak. May contain a component of ponderosa pine.
Microclimate – Mesic with some cold air drainage effects
Elevation – Upper most regions of Zone 1 through most of Zone 2.
Soil – Minimal development, rocky
Aspect – Generally northerly, can be trending south at its highest elevations in semi protected locations above the Yosemite Valley.
Shape – Always convex
Slope Position – Mid slope
Steepness - Moderately steep to extremely steep
Hydrology – Associated with riparian drainages
Fire – Persists with or without fire, canyon live oak resprouts following fire. Less frequent fire than canyon live oak-ponderosa pine and canyon live oak-California bay types.
Frequency – Uncommon, local and extremely restricted in size due to severe environment

Note, the following similar map units can be confused with this type:

- Mesic expressions of the Canyon Live Oak–Ponderosa Pine Association (1023) - can be misleading, however Douglas-fir usually has a distinctive crown signature as an emergent to canyon live oak.
- Canyon Live Oak-California Bay Association (1024) – has less than 2% conifer cover.

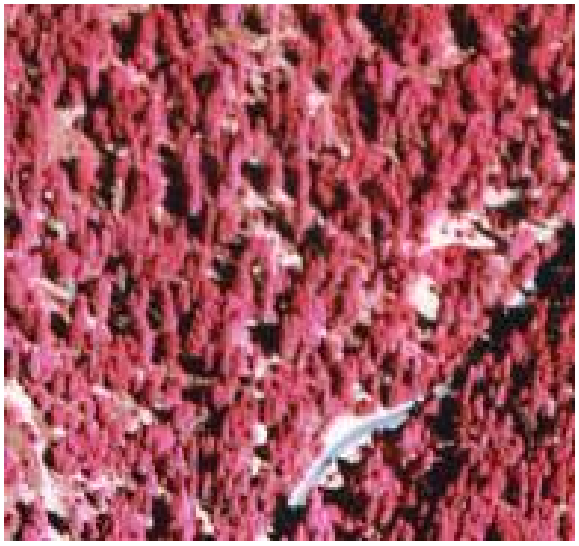
Key Photo Signature Notes: Note darker signature of emergent Douglas-fir – easily mistaken for pine in cases where individual conifers are sparse and small.

## 4013 - Douglas-fir - Ponderosa Pine - Incense-cedar Association (Zone2)

***Pseudotsuga menziesii-Pinus ponderosa-Calocedrus decurrens* Association**

Note: Aggregated to type 4550 in PIFinal field

Several areas were observed containing enough Douglas-fir to be placed in this type. This association is extremely transitional in nature and it is difficult to determine when Douglas-fir becomes an important enough component in a closed canopy forest to warrant labeling it this type. This type may also be transitional between the ponderosa pine-incense-cedar-California black oak type and the white fir-incense-cedar-sugar pine associations in Zone 3. Douglas-fir is often located by stream activity or in a fire suppressed area or where planted.



**4013 – Douglas-fir – Ponderosa Pine – Incense-cedar Association**

In this example there is also a small component of white fir. Douglas-fir shows up deeper red; ponderosa pine a lighter pink. This is a relatively xeric example taken near Harden Lake.

Taxa – Significant co-dominance of Douglas-fir (minimum 10-15% Douglas-fir) (5% to 25% reaching the canopy layer) along with ponderosa pine, incense-cedar creating a closed canopy forest (>60%). Sugar pine and/or white fir can be a minor component towards the higher elevation limits of this type. California black oak can occur in open late post fire settings.
Microclimate – Mesic
Elevation – Upper portions of Zone 2
Soil – Moderately well developed
Aspect – Always northerly
Shape – Always concave
Slope Position – Gentle
Steepness - Generally is moderately steep
Hydrology – Upland
Fire – Fire suppression

Frequency – Uncommon, more common in Stanislaus National Forest

Note, the following similar map units can be confused with this type:

- Ponderosa Pine-Incense-cedar-Black Oak Association (3063) - mesic expressions determined by elevations and aspects. May have <10-15% Douglas-fir, not as closed a forest.
- White Fir-Sugar Pine-Incense-cedar Superassociation (4094) – (at lower elevation limits) generally restricted to north facing aspects.

Key Photo Signature Notes: Douglas-fir yields a deeper magenta signature than ponderosa pine and rarely has the die-back associated with white fir.

### 4014 - Douglas-fir-White Alder Forest Association (Zone 2)
***Pseudotsuga menziesii-Alnus rhombifolia* Forest Association**

Taxa – A minimum of 10% relative cover of white alder and 10% relative cover of Douglas-fir in association with other riparian species (big leaf maple, red osier dogwood).
Microclimate – Mesic
Elevation – Zone 2
Soil – Moderately well developed by rocky due to streamside location.
Aspect – Neutral in valley bottoms, all aspects along tributary streams
Shape – Flat to concave (deeply concave on southerly exposures)
Slope Position – Valley bottoms and lower and mid slopes
Steepness – Flat to steep
Hydrology – Riparian
Frequency – Uncommon

**4014 – Douglas-fir – White Alder Forest Association**

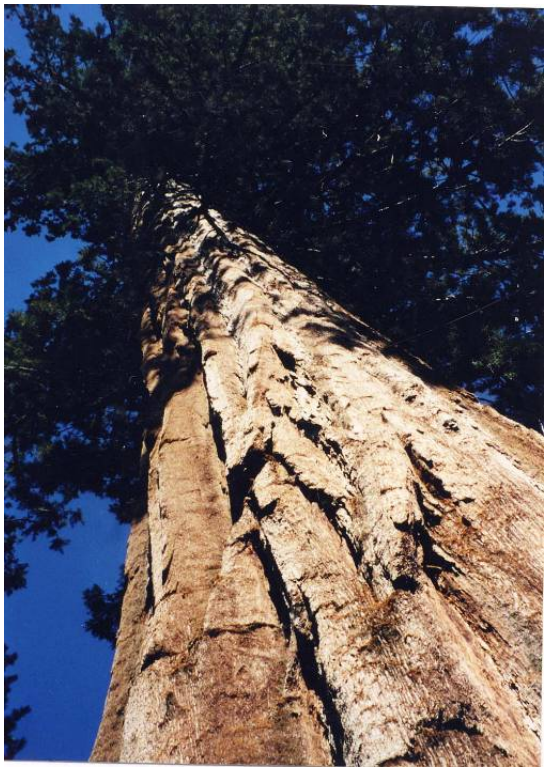
Uncommon and limited in extent, this narrow riparian band running from the center left to upper right portion of the image depicts alder in a surrounding Douglas-fir stand.

Note, the following similar map units can be confused with this type:

- White Alder Alliance (2060) – has less than 10% conifer, and 4014 is found in narrower canyons.

## 4020 - Giant Sequoia Forest Alliance (Zone 3)
***Sequoiadendron giganteum* Forest Alliance**

### 4021 - Giant Sequoia-Sugar Pine/Pacific Dogwood Forest Association (Zone 3)
***Sequoiadendron giganteum-Pinus lambertiana/Cornus nuttallii* Forest Association**



**4021 – Giant Sequoia – Sugar Pine / Pacific Dogwood Forest Association**

This example (Mariposa Grove) also contains a strong component of white fir. Several large giant sequoia's are emerging from the canopy in the upper left portion of the picture.

Observed in the Tuolumne and Mariposa groves. Several stands in the Mariposa Grove contained very large sugar pines mixed in with the giant sequoias.

Taxa – Giant sequoia and sugar pine in fairly dense to closed canopies with at least 1% giant sequoia relative cover, sugar pine making up a significantly greater co-dominant conifer than white fir, however white fir is usually present, often an understory conifer. Pacific dogwood was observed at most sites, but need not be present all of the time.
Microclimate – Typical of elevation
Elevation – 5500–7000 feet
Soil – Well developed, deep, granitic origin
Aspect – Variable
Shape – Variable
Slope Position – Generally lower slope except mid slope where trending northerly
Steepness – Slight to moderate
Geology – Granitic parent material
Hydrology – Mesic soils; topographic convergences resulting in lower slope, non-steep locations
Fire – Regular to frequent process in this type; fire rarely modifies overstory species composition but may dramatically alter understory, e.g., >90% cover of giant sequoia saplings (see Redwood Mountain site in Kings Canyon)
Frequency – Local to three or four stands at Yosemite
Note, the following similar map units can be confused with this type:

- White Fir – Incense-cedar – Sugar Pine adjacent to stands where sequoia may occur as a sparse component to the tree canopy.

## 4030 - Mountain Hemlock Forest Alliance (Zones 4 & 7)

***Tsuga mertensiana* Forest Alliance**

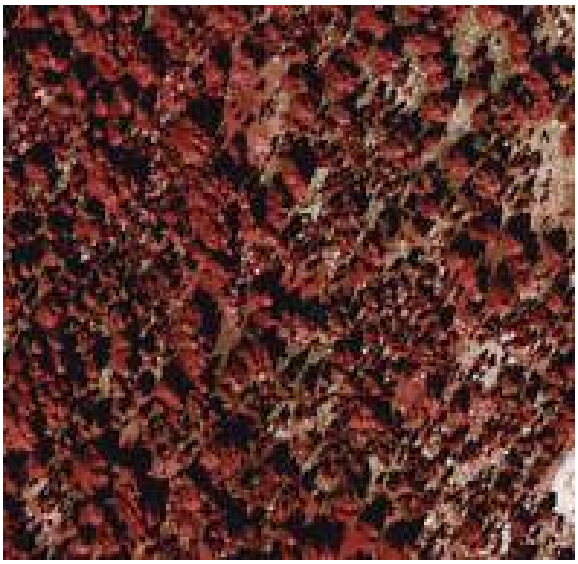
Note: Although still in classification as a place holder, aggregated to type 4035 in PIFinal field

### 4031 - Mountain Hemlock Association (Zone 4)

***Tsuga mertensiana* Association**

Note: Aggregated to type 4035 in PIFinal field

Note: Potter shows this type as usually occurring with California red fir, western white pine and Sierra lodgepole pine. Photointerpreters use this type in pure stands of mountain hemlock, mountain hemlock with a minor component of Sierra lodgepole pine, or mountain hemlock with California red fir in environments that are not as extreme as other mountain hemlock types.



**4031 - Mountain Hemlock Association**

This example, taken near Virginia Creek, contains a small component of Sierra lodgepole pine but is dominated by hemlock.

Zones 4 & 7

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 32). Tree cover is 22-88% and averages 68%.

| | Cons | Cov |
|---|---|---|
| Tree Overstory | | |
| Mountain hemlock | 100 | 23 |
| California red fir | 88 | 30 |
| Western white pine | 62 | 13 |
| Sierra lodgepole pine | 53 | 21 |
| Tree Understory | | |
| Mountain hemlock | 94 | 2 |
| California red fir | 78 | 4 |
| Western white pine | 75 | 1 |
| Sierra lodgepole pine | 38 | 1 |
| Shrubs | | |
| Alpine prickly currant | 22 | 1 |
| Sierra gooseberry | 22 | 1 |
| Forbs | | |
| Brewer's golden aster | 66 | 2 |
| Pinewoods lousewort | 50 | 1 |
| White flowered hawkweed | 34 | 2 |
| Pioneer rockcress | 31 | 1 |

Microclimate – Least severe of the hemlock types
Elevation – 7380 (8000 at Yosemite)-9160 feet, average is 8390 feet (usually above 8500 feet), Zone 4 & 7

Soil – Average 32”
Aspect – NE, N, NW (at higher elevations may trend south in protected concavities)
Shape – Concave
Slope Position – Lower to upper slopes
Steepness – 2-29%, average 18% (often less than 20%)
Frequency – More common in the northern half of the park & environs

Note, the following similar map units can be confused with this type:

- Mountain Hemlock/Pioneer Rockcress Association (4032) - occurs on steeper slopes, has a higher relative cover of western white pine, and less Sierra lodgepole pine. Often occurs upslope from mountain hemlock association.
- Mountain Hemlock-Sierra Lodgepole Pine/Mountain Heather & Mountain Hemlock-Sierra Lodgepole Pine/Ross Sedge Superassociation (4041) - may occur in densities as high as mountain hemlock association, but is generally higher elevation and lacks California red fir.
- California Red Fir Association (4051) - occurs in somewhat similar environments (however less restricted to concavities) and is generally found at lower elevations. Red fir associations often occur in less concave settings often below cirques, which contain the mountain hemlock association.
- California Red Fir–Western White Pine Association (4057) - generally occurs on adjacent steeper sideslopes in areas, which collect less snow accumulation than mountain hemlock association.
- California Red Fir-Sierra Lodgepole Pine/White-flowered Hawkweed Association (4063) – occurs downslope from 4031.

Key Photo Signature Notes: Higher elevation units mapped along north-south trending drainages north of Tuolumne Meadows often contain extensive stands of pure hemlock yielding a very dark magenta signature on the aerial photography.

## 4032 - Mountain Hemlock/Pioneer Rockcress Association (Zone 4 & 7)

***Tsuga mertensiana/Arabis platysperma* Association**

Note: Aggregated to type 4035 in PIFinal field

Mountain hemlock/pioneer rockcress is a “steep” type found at lower elevations than whitebark pine-mountain hemlock, which is also often found in steep settings. Potter nomenclature is mountain hemlock/steep association. Noted during the field reconnaissance in the upper portions of Lundy and Virginia Creek canyons, and at May and Tenaya lakes.

Taxa – Partial listing below, see Potter (1998) for complete listing: (Potter sample size = 17). Tree cover is 37-81%, and averages 65%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Mountain hemlock | 100 | 37 |
| Western white pine | 82 | 11 |
| California red fir | 76 | 23 |
| Tree Understory | | |
| Mountain hemlock | 100 | 2 |
| Western white pine | 94 | 1 |
| California red fir | 82 | 3 |
| Sierra lodgepole pine | 24 | 1 |
| Shrubs | | |
| None | | |
| Forbs | | |
| Pioneer rockcress | 53 | 1 |
| Waterleaf phacelia | 41 | 1 |

Microclimate – Late-lying snow into June or July
Elevation – 7120-9360 feet (usually above 7500 feet), averaging 8241 feet, Zone 4 & 7
Soil – Average 35”
Aspect – NW, N, NE
Shape – Concave
Slope Position – Upper slopes
Steepness – 30-60%, averaging 45%
Hydrology – Upland
Frequency – Rare below 8000 feet, restricted below 8500 feet, more extensive at 8500 to 9000 feet

**4032 – Mountain Hemlock/Pioneer Rockcress Association**

Somewhat more open than type 4031, the western white pine component is most noticeable in the southeastern portion of the picture. They tend to be a lighter signature than the hemlock. 4032 is mapped when California red fir is a component to the canopy.

Note, the following similar map units can be confused with this type:

- This type and many of the high elevation conifer types are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold. Therefore, several of the east side high elevation conifers can occur as complex units below the MMU. Severe cold often distorts the normal growth form of these conifers, making it difficult to separate out individual trees in some circumstances. This is especially true in shady steep north exposures.
- Mountain Hemlock-Western White Pine Association (4033) – does not contain a California red fir component and is found in more severe conditions, and at higher elevations.
- Whitebark Pine–Mountain Hemlock Association (3148) – does not contain western white pine and California red fir, but does contain whitebark pne and California red fir, and is generally found at higher elevations.

- Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Association (4042) – does not contain a California red fir component, and is generally found at higher elevations.

Key Photo Signature Notes: Mapped in areas where California red fir is noted if possible at lower elevations but in steep environments. All three conifer species (mountain hemlock, California red fir, and western white pine) are difficult to differentiate in this steep northerly setting. Look for western white pine in the drier edges of the stand.

## 4033 - Mountain Hemlock–Western White Pine Association (Zone 4 & 7)

***Tsuga mertensiana-Pinus monticola* Association**

Note: Aggregated to type 4035 in PIFinal field

Not differentiated from mountain hemlock/pioneer rockcress association in the field; basically the only difference is the absence of California red fir in this type.

Taxa – Generally moderately sparse stands of western white pine and mountain hemlock of at least 10% relative cover each.
Microclimate – Concave to neutral settings of heavy snow accumulation
Elevation – Upper portions of Zones 7 and 4

**4033 – Mountain Hemlock – Western White Pine Association**

Nearly impossible to distinguish from type 4043 or 403,2 this steeper, harsher type tends to minimize the Sierra lodgepole pine component.

Aspect – Northerly and northeasterly
Shape – Concave
Slope Position – Mid to upper slopes depending on elevation
Steepness – Moderately steep to steep
Hydrology – Upland
Frequency – Rare and constricted in size due to environmental conditions

Note, the following similar map units can be confused with this type:

- This type and many of the high elevation conifer types are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold. Therefore, several of the east side high elevation conifers can occur as complex units below the MMU. Severe cold often distorts the normal growth

form of these conifers, making it difficult to separate out individual trees in some circumstances. This is especially true in shady steep north exposures.

- Mountain Hemlock/Pioneer Rockcress Association (4032) - is differentiated only on the presence of California red fir, and is generally found at lower elevations than the mountain hemlock-western white pine association.
- Western White Pine Alliance (3130) - is found on adjacent ridgetops and lacks mountain hemlock.
- Whitebark Pine–Mountain Hemlock Association (3148) - is found at higher elevations above the western white pine limits.
- Mountain Hemlock-Sierra Lodgepole Pine-Whitebark Pine Association (4042) – does not contain western white pine, and is found at higher elevations.
- Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Association (4043) – occurs in less severe settings due to presence of Sierra lodgepole pine.

Key Photo Signature Notes: Map in areas where adjacent polygons contain no California red fir but are generally mapped as Sierra lodgepole pine-western white pine.

## 4035 - Mountain Hemlock-(Western White Pine-Sierra Lodgepole Pine) Forest Superassociation (Zones 4, 5, & 7)

***Tsuga mertensiana-(Pinus monticola-Pinus contorta var. murrayana)* Forest Superassociation**

Note: Aggregation type including original PI Codes 4030, 4031, 4032, 4033, 4041 & 4043

A lower elevation hemlock type with a component of mixed conifers.

Taxa – Mountain hemlock dominates stands or shares dominance with other high elevation conifers including western white and Sierra lodgepole pine. Lower elevation stands may have a component of California red fir in the canopy. Cover is generally dense.
Microclimate –Sub Mesic to mesic
Elevation – Zones 4 & 7
Aspect – Usually northerly
Shape – Concave
Slope Position –Mid to upper
Steepness – Variable
Hydrology – Upland
Frequency – Fairly common high elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- Higher elevation mountain hemlock types
- Lower elevation stands where California red fir dominates especially in cove like settings

Key Photo Signature Notes: Photointerpreters look for dense forests in coves and north trending concavities. Mountain hemlock tends to give off a deep red signature, somewhat darker than California red fir and with a more diffuse crown.

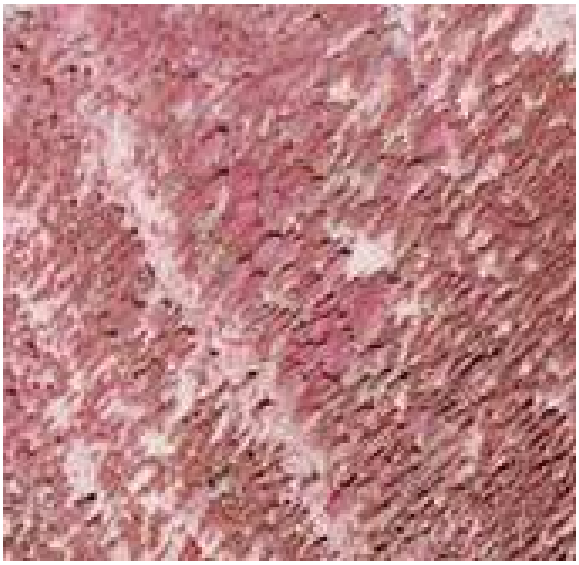
## 4041 - Mountain Hemlock-Sierra Lodgepole Pine Forest Association

***Tsuga mertensiana-Pinus contorta var. murrayana* Forest Association**

Note: Aggregated to type 4035 in PIFinal field

Structurally similar to mountain hemlock association (4031); usually found in moderately dense settings in similar environments to mountain hemlock association, but at higher elevations. Adjacent hemlock communities are mid and upper types (they contain no California red fir). Found in less mesic settings in eastside environments with Ross sedge often upslope from type 3041.

Taxa – At least 10% relative cover of both mountain hemlock and Sierra lodgepole pine in moderately dense to dense stands with no shrub understory.



**4041 – Mountain Hemlock-Sierra Lodgepole Pine Forest Association**

A typical forest example containing a slight dominance of Sierra lodgepole pine with mountain hemlock in the upper center of the photo.

Aspect – Northerly
Shape – Concave
Slope Position – Lower slopes
Steepness – Gentle to moderate
Hydrology – Upland

Note, the following similar map units can be confused with this type:

- Mountain Hemlock Association (4031) – is generally at a lower elevation and contains a component of California red fir.
- Sierra Lodgepole Pine/Ross Sedge (type 3041) – Mesic expressions of this type generally start to pick up hemlock toward protected slopes
- Mountain Hemlock-Sierra Lodgepole Pine-Whitebark Pine (4043) is a difficult break; generally occupying a somewhat harsher environment.

Key Photo Signature Notes: Possibly the least snowy hemlock; noted in eastside environments with a minor component of hemlock. In this setting, hemlock contrasts easily from the dominant lodgepole.

## 4042 - Mountain Hemlock- Sierra Lodgepole Pine-Whitebark Pine Association (Zones 4, 5 & 7)

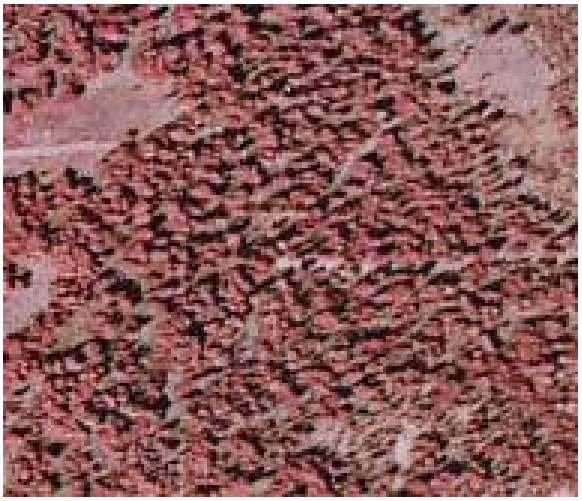
***Tsuga mertensiana-Pinus contorta var. murrayana-Pinus albicaulis* Association**

Note: Aggregated to type 3147 in PIFinal field

Taxa – Sparse to moderately dense stands of mountain hemlock, Sierra lodgepole pine, and whitebark pine with at least 10% relative cover for each species.
Microclimate – Less snow but possibly colder than areas containing pure mountain hemlock or mountain hemlock with western white pine and California red fir.
Elevation – Upper portions of Zone 7 and Zone 4; this is the highest association within the mountain hemlock alliance. Only the whitebark pine-mountain hemlock association is higher.
Aspect – Northerly
Shape – Concave to neutral
Slope Position – Upper slopes
Steepness – Steep
Frequency – Uncommon and restricted in size

Note, the following similar map units can be confused with this type:

- This type and many of the high elevation conifer types are extremely limited in extent on the east side due to harsh environmental conditions including relatively low precipitation and cold. Therefore, several of the east side high elevation conifers can occur as complex units below the MMU. Severe cold often distorts the normal growth form of these conifers, making it difficult to separate out individual trees in some circumstances. This is especially true in shady steep north exposures.
- Mountain Hemlock/Pioneer Rockcress Association (4032) - is found at lower elevations; presence of California red fir and western white pine is key to distinguishing this type from mountain hemlock-lodgepole-whitebark pine association
- Mountain Hemlock-Western White Pine Association (4033) - does not contain whitebark pine and is found at lower elevations.
- Whitebark Pine/Ross Sedge Association (3143) and Whitebark pine/Wheeler bluegrass association (3141) - usually occurs in areas with less snow accumulation
- Whitebark Pine-Mountain Hemlock Association (3148) – contain little or no Sierra lodgepole pine and occurs in more severe settings.



**4042 – Mountain Hemlock- Sierra Lodgepole Pine-Whitebark Pine Association**

A drier east side version probably containing a Ross sedge understory; this stand is dominated by Sierra lodgepole pine with lesser amounts of whitebark pine and hemlock.

Key Photo Signature Notes: Some of these hemlock phases may prove too tricky to map; floristic classifications have since lumped several hemlock types.

## 4043 - Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Association (Zones 4 & 7)

***Tsuga mertensiana-Pinus contorta var. murrayana -Pinus monticola* Association**

Note: Aggregated to type 4035 in PIFinal field

Extremely similar to mountain hemlock-western white pine association (4033); probably not separable on the photography; may occur in slightly less severe settings than just mountain hemlock-western white pine association (due to the presence of Sierra lodgepole pine).

Taxa – At least 10% relative cover of each (mountain hemlock, Sierra lodgepole pine, and western white pine).
Elevation – Occurs above mountain hemlock types with California red fir, occurs below mountain hemlock types with whitebark pine

**4043 – Mountain Hemlock-Sierra Lodgepole Pine-Western White Pine Association**

Often forming transitions between two types, this stand has more white pine near the rocky edges as it grades into type 3132.

Note, the following similar map units can be confused with this type:

- Mountain Hemlock–Western White Pine Association (4033) – occurs in more severe settings and does not contain Sierra lodgepole pine component.
- Mountain Hemlock/Pioneer Rockcress Association (4032) – contains a California red fir omponent and is found at lower elevations.

Key Photo Signature Notes: Some of these hemlock phases may prove too tricky to map; floristic classifications have since lumped several hemlock types.

## 4050 - California Red Fir Forest Alliance (Zones 4 & 7)

***Abies magnifica* Forest Alliance**

Note: Although still in classification as a place holder, aggregated to type 4056 in PIFinal field

### 4051 - California Red Fir Forest Association (Zone 4 & 7) [Potter]

***Abies magnifica* Forest Association**

Note: Aggregated to type 4056 in PIFinal field

Observed along the Glacier Point Road at the 7200 foot level, and on the Tioga Road between 7500 and 8000 feet.

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 167). Tree cover densities average 77%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| California red fir | 100 | 76 |
| Tree Understory | | |
| California red fir | 95 | 4 |
| Shrubs | | |
| None | | |
| Forbs | | |
| Spotted coral root | 48 | 1 |

Microclimate – This type occurs in the areas of heaviest snow accumulation within the park
Elevation – 6660-9240 feet, average 8017 feet; rare on east side, Zone 4 and 7
Soil – Average 38", low levels of bare ground, high litter cover
Aspect – NE, NW
Shape – Concave to slightly convex in open stands
Slope Position – Upper, middle, and lower slopes, seldom on ridges. At Yosemite, usually low to middle slopes
Steepness – 2-60% (24% average)
Hydrology – Well drained
Frequency – Fairly common, but restricted by environmental conditions and elevation

**4051 – California Red Fir Association**

Dense California red fir is the typical expression of this type with a pure cover of California red fir in this example.

Note, the following similar map units can be confused with this type:

- California Red Fir–Sierra Lodgepole Pine/White Flowered Hawkweed (4063) - is found downslope from 4051 usually on gentler slopes and contains a component of Sierra lodgepole pine.
- California Red Fir–White Fir Association (4071) - found at lower elevations.
- Jeffrey Pine-California Red Fir Association (3085) - found mainly in drier environments and contains Jeffrey pine in the canopy layer.
- Mountain Hemlock Association (4031) - is found in more concave settings (as opposed to canyon bottoms & low slope positions) at higher elevations.
- Sierra Lodgepole Pine/Woodland Association (3038) - often contain an element of California red fir, toward their mesic edges may be hard to differentiate.

## 4053 - California Red Fir – (Western White Pine) / Woolly Mule-ears Association (Zones 4 & 7)

***Abies magnifica*-(*Pinus monticola*)/*Wyethia mollis* Association**

Note: Aggregated to type 4069 in PIFinal field

Taxa – Red fir and at times western white pine in open stands with a variable understory that includes woolly mule-ears (*Wyethia mollis*).
Elevation – Zone 3
Soil – Derived from volcanic parent materials, predominantly volcanic lahar of the Mehrten formation (Potter, 1998).
Aspect – SE, SW
Shape – Neutral
Slope Position –Upper slopes
Steepness – Moderate to steep
Geology – Volcanic
Hydrology – Upland
Frequency – Uncommon to rare within the mapping area. Noted on Rancheria Mountain; possibly exists in the Mammoth Mountain area

**4053 – California Red Fir – (Western White Pine) / Woolly Mule-ears Association**

Mapped sparingly; this example on volcanics near the summit of Rancheria Mountain. Western white pine is a minor component to this stand.

Note, the following similar map units can be confused with this type:

- California Red Fir or California Red Fir – Western White Pine in open settings containing no mule-ears.

Key Photo Signature Notes: Mapped in settings where California red fir is in open stands with a very light signature representing a fairly sparse and dry understory.

## 4054 - California Red Fir/Mixed Shrub Mapping Unit (Zone 4)

***Abies magnifica*/Mixed Shrub Mapping Unit**

Note: Aggregated to type 4520 in PIFinal field

A couple of examples were noted near the roadside on Tioga, Glacier Point, Tamarack Flat roads and USFS road 6S07 that were below MMU.

Note: We attempted to separate out a California red fir/mixed shrub mapping unit (similar to California red fir–western white pine/mixed shrub superassociation – 4069). Pure stands of California red fir with shrub understory (bush chinquapin or pinemat manzanita) were occasionally observed above the California red fir association and below the Jeffrey pine /huckleberry oak association, or in close proximity to the Jeffrey pine/California red fir association. Several examples contained a white fir component.

Taxa – Partial listing below of Potter's (1998) California red fir/pinemat manzanita association. (Potter sample size = 28). Tree cover densities average 51%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| California red fir | 93 | 44 |
| Jeffrey pine | 29 | 22 |
| White fir | 21 | 6 |
| Tree Understory | | |
| California red fir | 89 | 1 |
| White fir | 25 | 1 |
| Shrubs | | |
| Pinemat manzanita | 100 | 43 |
| Bush chinquapin | 43 | 11 |
| Forbs | | |
| Pioneer rockcress | 64 | 1 |

Elevation – 7050-8800 feet, average of 7983 feet, Zone 4
Soil – Average 30"
Aspect – All
Shape – Convex
Slope Position - Ridges and upper slopes (at Yosemite, possibly a mid slope type between mesic California red fir association and more xeric Jeffrey pine-California red fir stands)
Steepness – 2-47%, average 24%

Note, the following similar map units can be confused with this type:

- California Red Fir–Western White Pine/Mixed Shrub Superassociation (4069) - seems to occur in slightly higher elevations. Contains a western white pine component.
- Jeffrey Pine-California Red Fir Association (3085) – usually does not contain a visible understory of shrubs.

## 4055 - California Red Fir-Western White Pine-Sierra Lodgepole Pine Association (Zones 4 & 7)

***Abies Magnifica-Pinus monticola-Pinus contorta var. murrayana* Association**

Note: Aggregated to type 4510 in Final PI field

Examples noted at the highest elevations along Glacier Point Road at approximately 7500 feet. Also noted along Tioga Road above 8000 feet on deep morainal soils.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 25). Tree cover is 37-91% and averages 63%.

| | Cons | Cover |
|---|---|---|
| Tree Overstory | | |
| Western white pine | 96 | 16 |
| Sierra lodgepole pine | 88 | 21 |
| California red fir | 84 | 33 |
| Tree Understory | | |
| Western white pine | 88 | 1 |
| California red fir | 88 | 4 |
| Sierra lodgepole pine | 72 | 1 |
| Shrubs | | |
| None | | |
| Forbs | | |
| Pioneer rockcress | 72 | 1 |
| Pinewoods lousewort | 52 | 2 |

Elevation – 7360-9460 feet, common above 8500', Zone 4 and 7
Aspect – NE, NW
Steepness – 3-65%, average 24%
Hydrology – Excessively well drained

**4055 – California Red Fir-Western White Pine-Sierra Lodgepole Pine Association**

In this example, California red fir, more common in the NW corner makes up about 40% relative cover; Sierra lodgepole pine and western white pine are less dominant.

Note, the following similar map units can be confused with this type:

- California Red Fir–Western White Pine Association (4057) - occurs on more severe slopes generally downslope from California red fir–western white pine–Sierra lodgepole pine association.
- California Red Fir-Western White Pine/Mixed Shrub Superassociation (4069) - occurs on more exposed sites (allowing for the presence of a shrub cover) and has a sparser canopy cover.
- Jeffrey Pine-California Red Fir (3085) - often occurs in similar slope positions but on opposing slopes - observed on the opposite (south) side of a "bald" at similar slope positions).
- Western White Pine/Western Needlegrass Association ( 3131) – is usually less mesic, with a sparser canopy, very little California red fir component, on higher slopes, and slightly higher in elevation.
- Western White Pine-Sierra Lodgepole Pine Association (3132) – is generally higher in elevation and contains little California red fir.

Key Photo Signature Notes: A difficult type to map in most settings, western white pine crown is often reduced in size making it difficult to tell from Sierra lodgepole pine.

## 4056 - California Red Fir-(Sierra Lodgepole Pine) Forest Superassociation (Zones 4 & 7)

***Abies magnifica-(Pinus contorta var. murrayana)* Forest Superassociation**

Note: Aggregation type including original PI Codes 4050, 4051 & 4063

A higher elevation conifer type composed primarily of fir

Taxa – California red fir generally dominates the canopy; less steep settings often have a significant component or co-dominance of Sierra lodgepole pine. Conifer cover is usually very dense; understory components are generally sparse with little or no shrub component.
Microclimate –Sub Mesic to mesic
Elevation – Zones 4
Aspect – Variable
Shape – Neutral to concave
Slope Position – Lower to mid
Steepness – Level to moderately steep
Hydrology – Upland
Frequency – Very common and extensively mapped high elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- Mesic Sierra lodgepole pine stands with a small component of California red fir
- Mesic mixed red & white fir stands

Key Photo Signature Notes: Red fir is difficult to distinguish from white fir except that there is generally less tree-top loss on the California red fir. Crowns are somewhat larger also. Aggregated type is generally very dense in cover; Sierra lodgepole pine component is often not detectable on the aerial photography unless it is over about 20% cover.

## 4057 - California Red Fir-Western White Pine Association (Zones 4 & 7)

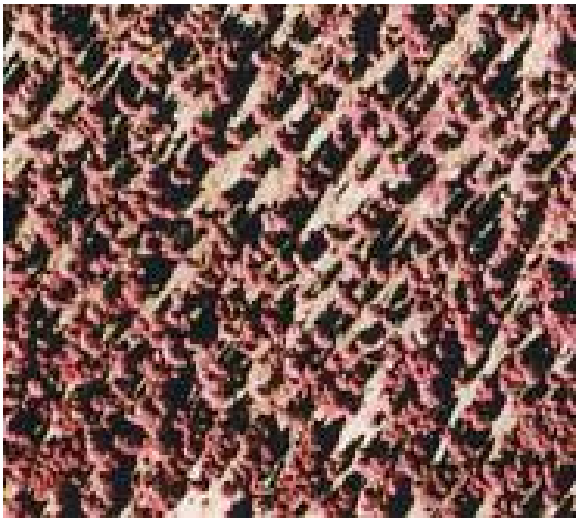
***Abies magnifica-Pinus monticola* Association**

Note: Aggregated to type 4510 in PIFinal field

Examples of California red fir and western white pine without Sierra lodgepole pine were noted only on a few ridges. See Potter (1998) for description.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 35). Tree cover is 20-91% and averages 66%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Western white pine | 100 | 15 |
| California red fir | 100 | 50 |
| Tree Understory | | |
| California red fir | 97 | 4 |
| Western white pine | 54 | 1 |
| Shrubs | | |
| None | | |
| Forbs | | |
| Pinewoods lousewort | 60 | 1 |
| Pioneer rockcress | 49 | 1 |



**4057 – California Red Fir-Western White Pine Association**

Nearly impossible to separate out from type 4055; (with Sierra lodgepole pine). A typical example noted here as a dense woodland to forest setting on moderately steep mid to upper slopes.

Elevation – 7140-9520 feet, average 8465 feet, most frequently above 8500 feet, Zone 4 and 7
Soil – Well to excessively well drained
Aspect – NE, NW
Slope Position - Ridges, upper and mid slopes
Steepness – Moderate to steep, 25% average, mostly over 35%
Geology – Usually granitic, but may be volcanic, metamorphic or sedimentary

Note, the following similar map units can be confused with this type:

- California Red Fir–Western White Pine–Sierra Lodgepole Pine Association (4055) - is generally found upslope from this type on more gentle tops of balds.
- Jeffrey Pine-California Red Fir Association (3085) - is often found on the same “bald” but on the southern side of it.
- Western White Pine/Western Needlegrass Association (3131) – is usually less mesic, with a sparser canopy, very little California red fir component, on higher slopes, and slightly higher in elevation.
- Mountain Hemlock Association (4031) – generally occurs on adjacent concavities, which collect more snow accumulation.
- Mountain Hemlock/Pioneer Rockcress Association (4032) – is often adjacent to 4057on north-facing concave upper slopes. Occurrence is restricted below 8500 feet elevation.
- California Red Fir-Western White Pine/Mixed Shrub Superassociation (4069) – contains a shrub understory and is on more rocky settings.

Key Photo Signature Notes: Often mapped as dense woodlands, usually found on upper north facing long ridgelines just below types 4055 or 3132. All the conifers are hard to distinguish in this closed setting.

## 4063 - California Red Fir-Sierra Lodgepole Pine/Whiteflowered Hawkweed (Zone 4) [Potter]

***Abies magnifica-Pinus contorta var. murrayana /Hieracium albiflorum***

Note: Aggregated to type = 4056 in PIFinal field

Fairly extensive stands of California red fir and Sierra lodgepole pine were noted during the field reconnaissance along the Glacier Point Road and Tioga Road above 6500 feet usually midway between cold air basins and higher slopes. Often adjacent to Sierra lodgepole pine/Gray lovage association, Sierra lodgepole pine/Kentucky bluegrass association, Sierra lodgepole pine/western blueberry association, or California red fir association.

**Note: We have occasionally mapped this type at lower elevations, which probably contain more white fir than California red fir.**

**4063 – California Red Fir – Sierra Lodgepole Pine**

In this example, California red fir (pinker signature) makes up about 40% of the relative cover, with Sierra lodgepole pine (brown color) about 60%.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 48). Tree cover is 43-95% averaging 73%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| California red fir | 98 | 49 |
| Sierra lodgepole pine | 100 | 20 |
| White fir | 27 | 23 |
| Tree Understory | | |
| California red fir | 96 | 6 |
| Sierra lodgepole pine | 67 | 1 |
| White fir | 38 | 2 |
| Shrubs | | |
| None | | |
| Forbs | | |
| Pinewoods lousewort | 65 | 1 |
| White flowered hawkweed | 46 | 3 |

Microclimate – Intermediate between cold air drainages and adjacent higher slopes
Elevation – 6540-9520 feet, average 7831 feet, Zone 4
Soil – 37” average (deep)
Aspect – NE and NW favored
Slope Shape – Variable
Slope Position - Low slopes and benches and adjacent to meadows and drainage bottoms
Slope Steepness – 2-40%, average 13% (usually less than 20%)
Hydrology – Well drained
Frequency – Fairly common, mapping units are occasionally large

Note, the following similar map units can be confused with this type:

- California Red Fir Association (4051) - contains no Sierra lodgepole pine and is usually found upslope in narrower canyons and drainages that are usually steeper than this type.

- Sierra Lodgepole Pine/Woodland Association (3038) - often contains California red fir, but is significantly drier, and usually more open than 4063.
- Mountain Hemlock Association (4031) - occurs upslope from 4063 in concavities.
- Sierra Lodgepole Pine/Western Blueberry & Sierra Lodgepole Pine/Kentucky Bluegrass Superassociation (3022) – usually contains very little California red fir, and is more mesic occurring along the edges of meadows.
- Sierra Lodgepole Pine Mesic Expression Superassociation (3048) – usually contains very little California red fir, and generally occurs at higher elevations than 4063).
- Mountain Hemlock Association (4031) stands at lower elevations where mountain hemlock is just starting to pick up in the canopy layer, but Sierra lodgepole pine and California red fir still are strong co-dominants.

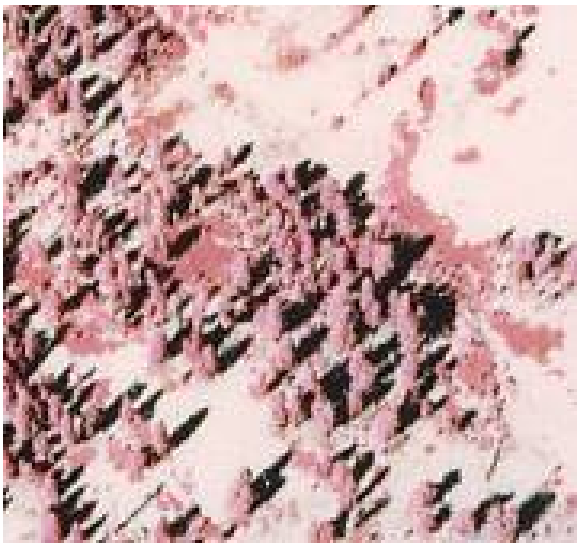
Key Photo Signature Notes: This association can vary somewhat in environment; mapped where both conifers are present from a mesic environment which may be a Sierra lodgepole pine/Gray lovage association to a xeric edge which may grade into a Sierra lodgepole pine woodland with a fir component.

## 4069 - California Red Fir-(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation (Zones 4 & 7)

***Abies magnifica-(Pinus monticola)/( Chrysolepis sempervirens-Quercus vaccinifolia)* Forest Superassociation**

Note: Aggregation type that contains type 4053 in PIFinal field

Taxa – California red fir and western white pine in moderately open stands with at least 10% shrub cover (usually bush chinquapin or pinemat manzanita; occasionally huckleberry oak near drier edges).
Microclimate – On more exposed (higher solar) than California red fir–western white pine association (4057).
Elevation – 8000-9200 feet, Zone 4 and 7
Soil – 33” average
Aspect – NE, NW for California red fir-western white pine/bush chinquapin; SE, SW for California red fir-western white pine/pinemat manzanita.
Slope Shape –Variable
Slope Position - Upper slopes
Slope Steepness – 25-65%, average 39%
Frequency – Fairly common, often in transitional areas between Jeffrey pine and western white pine associations.



**4069 – California Red Fir-(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation**

Using shadows is occasionally helpful in PI identification of species. Note western white pine shadows in the lower right portion of the photo and firs in the lower left.

Note, the following similar map units can be

confused with this type:

- California Red Fir–Western White Pine Association (4057) - contains no shrub understory and is in less rocky settings.
- Jeffrey Pine–Huckleberry Oak Association (3075) - (samples with a high California red fir component) occurs on more exposed sites. Jeffrey pine crown is rounder, fuller and less irregular than western white pine. Western white pine generally gives off more IR yielding a pinker signature.
- Western White Pine/Western Needlegrass Association ( 3131) has a sparser canopy, very little California red fir component, on higher slopes, and slightly higher in elevation.
- California Red Fir/Mixed Shrub Mapping Unit (4054) – occurs at slightly lower elevations. Does not contain a western white pine component.
- California Red Fir-Western White Pine-Sierra Lodgepole Pine (4055) – occurs on less exposed sites and has a denser canopy cover and much less shrub cover.
- Sierra Lodgepole Pine – Western White Pine may in some cases contain a shrub understory that could throw off the photointerpreters.

Key Photo Signature Notes: PI caution in using shrub layer in determining this type. Higher elevation stands will lack the presence of California red fir and be replaced by Sierra lodgepole pine.

## 4070 - California Red Fir–White Fir Forest Alliance (Zones 3 & 7)

***Abies magnifica-Abies concolor* Alliance**

Note: Aggregation type including original PI Codes 4071, 4072,4073 and Pre-Final PI Code 4074 in PIFinal field

### 4071 - California Red Fir–White Fir Forest Association (Zones 3 & 7)

***Abies magnifica-Abies concolor* Forest Association**

Note: Aggregated to type 4070 (Alliance level) in PIFinal field

Frequently observed during the field reconnaissance on Tioga Road, Tamarack Flat Road, USFS Roads 6S07 and 5S06, and Glacier Point Road at elevations from 6400-7400 feet. Zone of overlap between these two species of Fir is fairly extensive.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 69). Tree cover is 48-97%, averaging 78%. Has no Jeffrey pine or sugar pine.

| Tree Overstory | Cons | Cover |
|---|---|---|
| California red fir | 100 | 55 |
| White fir | 94 | 25 |
| Tree Understory | | |
| California red fir | 97 | 2 |
| White fir | 71 | 2 |
| Shrubs | | |
| Sierra gooseberry | 29 | 1 |
| Trailing snowberry | 29 | 4 |
| Bush chinquapin | 22 | 5 |
| Forbs | | |
| Whiteveined wintergreen | 49 | 1 |
| White flowered hawkweed | 48 | 2 |

**4071 – California Red Fir – White Fir Association**

Found in deep protected ravines, this example is about 70% white fir. Generally, California red fir is slightly darker and overall is larger then the white fir although in most cases on an individual basis are nearly inseparable.

Microclimate – Mesic, most mesic of the three California red fir-white fir types
Elevation – As low as 6100 adjacent to meadows, but otherwise 6300 up to 7500 feet, Zone 3
Soil – 39” average
Aspect – Northerly facing
Shape – Concave
Slope Position - Lowest slopes and draws
Steepness – Fairly steep
Hydrology – Well drained
Frequency – Common and fairly extensive

Note, the following similar map units can be confused with this type:

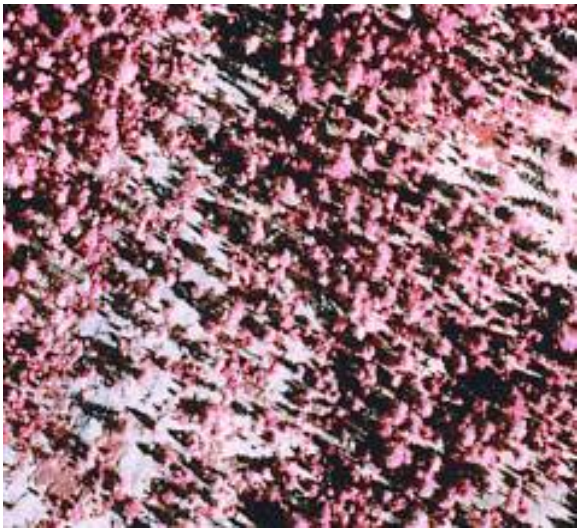
- California Red Fir–White Fir–Jeffrey Pine Association (4072) - is often adjacent to this type on drier convex upper slopes. Also has Jeffrey pine. Canopy is not as dense.
- California Red Fir-White Fir-Sugar Pine Association (4073) - is a slightly drier type, on mid and upper slopes. Also has sugar pine.
- White Fir Superassociation (4081) – occurs at lower elevations. Also may contain some sugar pine.
- White Fir-Incense-cedar-Sugar Pine Superassociation (4094) – occurs upslope from this type but at lower elevations. Also has sugar pine.
- California Red Fir Association (4051) – is found at higher elevations.

Key Photo Signature Notes: Small stands of this type are nearly impossible to distinguish from other fir types.

## 4072 - California Red Fir-White Fir-Jeffrey Pine Forest Association (Zone 3)

***Abies Magnifica-Abies Concolor- Pinus jeffreyi* Forest Association**
**Note: Aggregated to type 4070 (Alliance level) in PIFinal field**

Frequently observed along Tioga Road, Tamarack Flat Road and Glacier Point Road between 7000 and 7500 feet



**4072 – California Red Fir – White Fir – Jeffrey Pine Association**

Generally more open than type 4073, this example has a minor shrub component to the rocky understory.

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 31). Tree cover is 30-90%, averaging 65%. No sugar pine.

| Tree Overstory | Cons | Cover |
|---|---|---|
| White fir | 90 | 26 |
| Jeffrey pine | 90 | 18 |
| California red fir | 84 | 29 |
| Tree Understory | | |
| California red fir | 81 | 2 |
| White fir | 68 | 1 |
| Jeffrey pine | 29 | 1 |

Microclimate – Submesic
Elevation – 6500-8500 feet, Zone 3
Aspect – SE, SW, but varied
Shape – Concave
Slope Position – Upper slopes
Steepness – 0-57%, average 25%, usually 20-35%
Hydrology – Upland
Fire – Moderately frequent, likely to result in higher understory cover of whitethorn ceanothus, bush chinquapin, or other shrubs

Note, the following similar map units can be confused with this type:

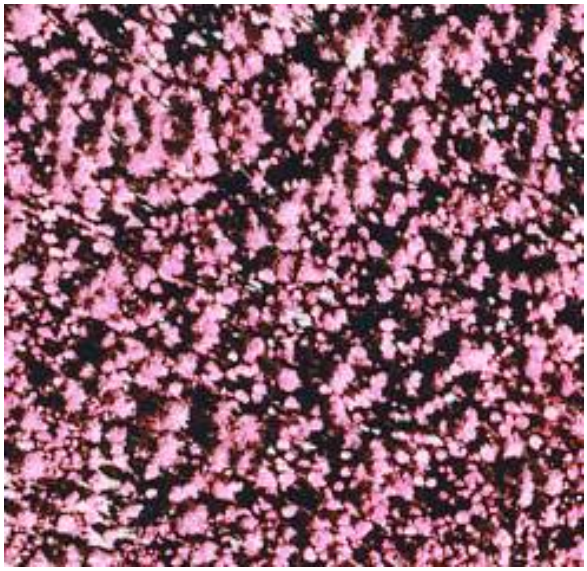
- Jeffrey Pine- California Red Fir Association (3085) - is found at higher elevations and drier settings.
- California Red Fir-White Fir–Sugar Pine (4073) - is extremely close to this type, but contains sugar pine.
- California Red Fir-White Fir Association (4071) – is more mesic, is found on lower slopes, and does not contain Jeffrey pine. Canopy is denser.
- White Fir Superassociation (4081) – is more mesic, is found at lower elevations and on lower slopes, and does not contain Jeffrey pine. Canopy is denser.
- White Fir-Sugar Pine-Incense-cedar Superassociation (4094) – is more mesic, is found at lower elevations on mid slopes, and does not contain Jeffrey pine. Contains sugar pine, and canopy is more dense.
- Jeffrey Pine-White Fir (West Side) & White Fir-Sugar Pine-Jeffrey Pine Superassociation (3086) – is slightly lower in elevation

Key Photo Signature Notes: Generally a woodland type where Jeffrey pine is usually identifiable with its larger rounded crown. Adjacent stands of mixed red and white fir are also a clue to this drier type.

## 4073 - California Red Fir-White Fir-Sugar Pine Forest Association (Zone 3)

***Abies magnifica-Abies concolor-Pinus lambertiana* Forest Association**

Note: Aggregated to type 4070 (Alliance level) in PIFinal field



**4073 – California Red Fir-White Fir-Sugar Pine Forest Association**

Very similar to type 4094, but at slightly higher elevations; sugar pines have the diffuse crown, California red fir generally yields a somewhat deeper magenta signature than white fir.

Observed during field reconnaissance over extensive areas on the Tamarack Flat Road, USFS Road 6S07 and on Tioga Road between 6500 and 7000 feet. It was noted in the field that this type can have a substantial component of Jeffrey pine and may have some incense-cedar at lower elevations.

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample size = 33). Tree cover is 37-93%, averaging 76%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| White fir | 97 | 33 |
| California red fir | 97 | 32 |
| Sugar pine | 61 | 13 |
| Jeffrey pine | 21 | 19 |
| Incense-cedar | 15 | 13 |

Microclimate – Mesic to submesic
Elevation – 6500-7500 feet, Zone 3
Soil – 10”,average
Aspect – All
Shape – Usually neutral
Slope Position – Seldom lower; usually mid and upper slopes,
Steepness – 3-60%, average 27%
Hydrology – Upland
Fire – Moderately frequent, likely to result in higher understory cover of whitethorn ceanothus, bush chinquapin, or other shrubs
Frequency – Common and often extensive

Note, the following similar map units can be confused with this type:

- California Red Fir–White Fir–Jeffrey Pine Association (4072) - is extremely close to this type. Contains no sugar pine. Occurs on upper slope convexity. Density is more open.
- White Fir–Sugar Pine-Incense-cedar Superassociation (4094) - is at lower elevations and may contain a component of incense-cedar or ponderosa pine.
- White Fir Superassociation (4081) – occurs at lower elevations
- California Red Fir–White Fir Association (4071) - occurs on more mesic sites and on lower slopes. Does not contain sugar pine or Jeffrey pine. Canopy is very dense.
- Jeffrey Pine-White Fir (West Side) & White Fir-Sugar Pine-Jeffrey Pine Superassociation (3086) – usually occupies higher slope positions at slightly lower elevations than 4073 situations with Jeffrey pine.

Key Photo Signature Notes: Quite often has a minor shrub component or a component of rockiness to the stand.

### 4074 - California Red Fir-White Fir-(Sugar Pine-Jeffrey Pine) Forest Superassociation (Zone 3)

***Abies magnifica-Abies concolor-(Pinus lambertiana-Pinus jeffreyi)* Forest Superassociation**

Note: PIPreFinal aggregation type includes original PI Codes 4070, 4071, 4072 & 4073 and is aggregated to 4070 in the PIFinal field

A mid elevation mixed conifer type dominated by mixed fir.

Taxa – Either California red fir or white fir dominate or co-dominate the canopy; more xeric stands often contain a component of sugar or Jeffrey pine. Sugar pine is also a more common component to lower elevation stands while Jeffrey pine becomes increasingly common upslope often adjacent to rock outcroppings and shallow soils.
Microclimate –Xeric to Sub Mesic
Elevation – Zones 4
Aspect – Variable
Shape – Variable
Slope Position – Lower to upper
Steepness – Moderate to rather steep
Hydrology – Upland
Frequency – Very common and extensively mapped mid elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- California Red Fir stands with a pine component
- Lower elevation stands dominated by white fir with or without pines

Key Photo Signature Notes: An aggregation where photointerpreters can reliably interpret mixing of the two Fir species but have trouble assessing the component of either sugar or Jeffrey pine. White fir tends to have greater top die-off than the larger crowned California red fir.

### 4080 - White Fir Forest Alliance (Zone 3)

***Abies Concolor* Forest Alliance**

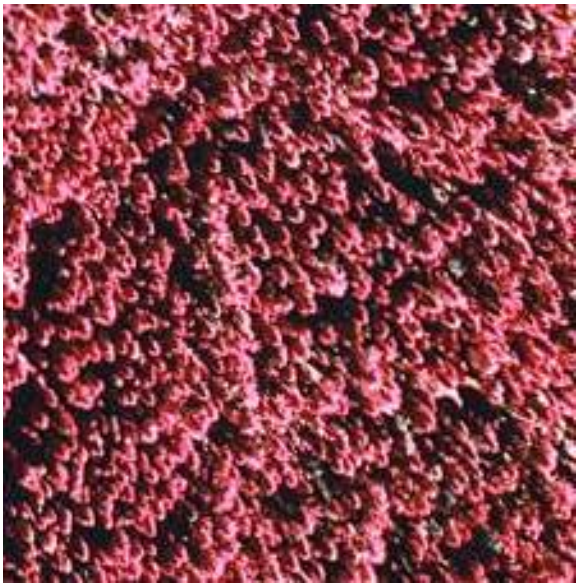
Note: Although still in classification as a place holder, aggregated to type 4530 in PIFinal field

### 4081 - White Fir Mapping Unit (Zone 3)

***Abies Concolor* Mapping Unit**

Note: Aggregated to type 4530 in PIFinal field

Taxa – Stands of predominantly white fir, but could have minor components of sugar pine and incense-cedar. Starts mixing with California red fir at uppermost extent, and with increased amounts sugar pine upslope. Actual extent is very narrow.
Microclimate – Mesic
Elevation – 5300 to 6400, lower half of Zone 3
Shape – Concave
Slope Position – Lower slope, occasionally mid slope when north trending
Steepness – Moderate to high
Hydrology – Upland
Frequency – Limited in extent by similar types



**4081 – White Fir Mapping Unit**

Restricted to narrow ravines and protected coves, this type is often limited by the presence of sugar pine upslope.

Note, the following similar map units can be confused with this type:

- White Fir-Incense-cedar-Sugar Pine Superassociation (4094) – contains a significantly lower component of white fir.
- California Red Fir-White Fir Association (4071) – occurs at higher elevations. Has no sugar pine.
- California Red Fir-White Fir-Jeffrey Pine Association (4072) – is less mesic and found at higher elevations and on higher slopes. Contains Jeffrey pine whereas 4081 does not. Canopy is less dense.
- White Fir-Sugar Pine-California Red Fir Association (4073) – occurs at higher elevations.

Key Photo Signature Notes: Mapped where little or no sugar pine is observed in narrow protected ravines and coves. Crown canopy appears as a uniform White fir signature.

## 4084 - White Fir/Whitethorn Ceanothus Forest Association (Zone 3)

***Abies Concolor/Ceanothus cordulatus* Forest Association**

Note: Aggregated to type 4520 in PIFinal field

**4084 – White Fir/Whitethorn Ceanothus Forest Association**

In this example, white fir is variable in density throughout, with a locally patchy dense cover of whitethorn ceanothus in the understory.

Taxa – Open to moderately closed stands of white fir over a discontinuous layer of whitethorn ceanothus. Jeffrey pine or sugar pine may be a minor component in the canopy layer.
Elevation – 5500 to 6500, middle of Zone 2
Fire – Late post fire examples noted

Note, the following similar map units can be confused with this type:

- Jeffrey Pine-Whitethorn Ceanothus (3073) – is much less common than 4084. Jeffrey pine is a major component in the canopy of type 3073.
- White Fir-Sugar Pine-Incense-cedar/Mixed Shrub Mapping Unit (4095) is extremely similar to this type but is generally mapped with a mixed conifer overstory to a variable shrub layer.

Key Photo Signature Notes: Generally mapped as small openings in white fir and white fir-sugar pine types in post fire settings. Whitethorn ceanothus signature trends uniform smooth and pink.

## 4085 - White Fir Eastside Mapping Unit (Zone 7)

***Abies Concolor* Eastside Mapping Unit**

Note: During the AA process this type was created in order to keep white fir types that may have a component of sugar pine separate from white fir with no sugar pine. It occurs on the east side of the mapping area.

Taxa – White fir dominates the canopy cover in small stands; usually dense cover often with a minor component of riparian species such as black cottonwood. Sierra lodgepole or Jeffrey pine may be a minor component to the overstory.
Elevation – Lower portions of zone 7 and upper portions of zone 8
Aspect – Northerly when not riparian
Shape – Concave
Slope Position – Low
Steepness – Can be steep adjacent to riparian on north slope
Hydrology – Upland or riparian
Frequency – Rare as an eastside type; stand size small

Note, the following similar map units can be confused with this type:

- Jeffrey Pine-White Fir
- Sierra Lodgepole Pine - in riparian settings with a component of white fir

Key Photo Signature Notes: Small eastside stands can be confused with Sierra lodgepole pine, especially along north trending slopes above Buckeye Creek. Stands often have Jeffrey pine toward drier margins where it transitions to Jeffrey pine-white fir.

## 4090 - White Fir-Sugar Pine Forest Alliance (Zone 3)

***Abies concolor-Pinus lambertiana* Forest Alliance**

Note: Although still in classification as a place holder, aggregated to type 4530 in PIFinal field

### 4094 - White Fir-Sugar Pine-Incense-cedar Superassociation (Zone 3)

***Abies concolor-Pinus lambertiana-Calocedrus decurrens* Superassociation**

Note: Aggregated to type 4530 in PIFinal field

**4094 – White Fir-Sugar Pine-Incense-cedar Superassociation**

A mesic example of this type; probably with an understory of trailplant. White fir in this example have some die-back on the tops. Note the star-like crowns of the mature sugar pine.

Taxa – Partial listings below from two expressions; see Fites (1993) for complete listings from similar types. (Fites' sample sizes = 27 and 17, respectively).

1. White fir-sugar pine-incense-cedar/trailplant sssociation. Observed during field reconnaissance in lower elevations of Zone 3 in mesic draws and canyons:

| Tree Overstory | Cons | Cover |
|---|---|---|
| White fir | 100 | 52 |
| Incense-cedar | 96 | 25 |
| Sugar pine | 88 | 16 |
| Douglas-fir | 77 | 37 |
| Ponderosa pine | 44 | 14 |
| Tree Understory | | |
| Incense-cedar | 100 | 6 |
| White fir | 96 | 4 |
| Douglas-fir | 74 | 2 |
| Sugar pine | 63 | 1 |

2. White fir-sugar pine-incense-cedar/creeping snowberry/kelloggia association (Fites, 1993). Abundant, and extensive in the lower portions of Zone 3. Often occurring adjacent to the ponderosa pine–incense-cedar–black oak association in more mesic settings at its lowest elevations.

| Tree Overstory | Cons | Cover |
|---|---|---|
| White fir | 100 | 66 |
| Incense-cedar | 94 | 30 |
| Sugar pine | 82 | 23 |
| Ponderosa pine | 47 | 17 |
| Jeffrey pine | 35 | 24 |

| | | |
|---|---|---|
| Tree Understory | | |
| White fir | 94 | 5 |
| Incense-cedar | 88 | 4 |
| Sugar pine | 47 | 1 |
| California black oak | 41 | 1 |

Elevation – 5200-6500 feet at Yosemite, Zone 3
Aspect – N, NE, NW
Shape – Concave
Slope Position – Lower slopes and bottoms, swales and benches
Steepness – 4-60%, average 26%
Geology – n/a
Hydrology – Upland
Fire – Moderately frequent, likely to result in higher understory cover of deerbrush, littleleaf ceanothus, or other shrubs
Frequency – Abundant and often extensive; trail plant variant more confined to draws

Note, the following similar map units can be confused with this type:

- California Red Fir-White Fir Association (4071) – Occurs downslope from 4094 at higher elevations. Does not have sugar pine.
- California Red Fir-White Fir-Jeffrey Pine (4072) – is less mesic, is found at higher elevations and on upper slopes. Contains Jeffrey pine and no sugar pine. Canopy is not as dense.
- White Fir-Sugar Pine-California Red Fir (4073) – is at higher elevations and does not contain incense-cedar or ponderosa pine.
- White Fir Mapping Unit (4081) – contains significantly higher component of white fir.
- Douglas-fir-White Fir Association (4011) – is found downslope from 4094 and at lower elevations.
- Ponderosa Pine – Incense-cedar – Black Oak (3063) often forms extensive transitions to this type, but is generally mapped where white fir no longer becomes a significant canopy component to the overstory.

Key Photo Signature Notes: May form extensive transitions between type 3063 at lower elevations and 4073 at higher elevations. In these settings, it can be extremely difficult to accurately split.

## 4100 - Sierra Juniper Woodland Alliance (Zones 4, 7 & 8) [Potter]

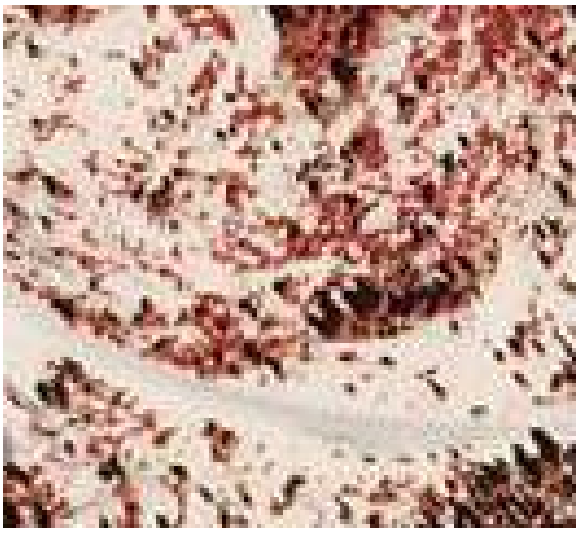
***Juniperus occidentalis var. australis* Woodland Alliance**

Note: Aggregation type including original PI Code 4103

### 4101 - Sierra Juniper/(Oceanspray) Woodland Superassociation

***Juniperus occidentalis var. australis (Holidiscus microphyllus)* Woodland Superassociation**

Frequently observed during field reconnaissance along Tioga Road above 8000 feet on granitic domes as a sparse tree layer, always with a Jeffrey pine component.



**4101 – Sierra Juniper (Oceanspray) Woodland Superassociation**

Sierra juniper and Jeffrey pine co-dominate over a sparse understory of huckleberry oak in this typical example.

Taxa – Partial listing below; see Potter (1998) for complete listing. (Potter sample size = 12). Tree cover is 3-79%, averaging 33%. At Yosemite tree cover is about 10%.

| Tree Overstory | Cons | Cover |
|---|---|---|
| Sierra juniper | 92 | 12 |
| Sierra lodgepole pine | 58 | 12 |
| Jeffrey pine | 50 | 9 |
| Tree Understory | | |
| Sierra juniper | 67 | 1 |
| Sierra lodgepole pine | 58 | 1 |
| Jeffrey pine | 25 | 1 |

Microclimate – Xeric
Elevation –7560–8960 feet, average 8133 feet, Zone 4. At Yosemite, elevation is 6500-10,000 feet.
Soil – 30” average, where soil is developed (mainly rocky with little soil development)
Aspect – SE, SW
Shape – Convex
Slope Position – Upper slopes
Steepness – 19-58%, average 32%
Geology – On granite domes and steep cliff faces
Hydrology – Upland
Fire – Infrequent
Frequency – Common, widely ranging in extent

Note, the following similar map units can be confused with this type:

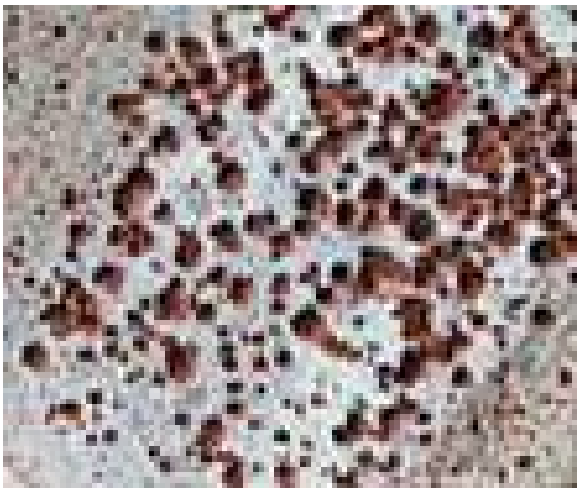
- Jeffrey Pine/Huckleberry Oak Association (3075) - in sparse settings is difficult to distinguish from this type, but is usually found on less severe slopes in less broken rocky environments.
- Sierra Lodgepole Pine Sparse Outcrop Woodland Mapping Unit (3021) – generally occurs in less steep environments and has an extremely sparse tree layer. It may be difficult to accurately delineate the boundary between 3021 and 4101.
- Sierra Juniper/Big Sagebrush Association (4103) – occurs on mid to upper slopes on the east side.
- Sierra Juniper/Curl-leaf Mountain Mahogany-(Big Sagebrush) Association (4107) – occurs on mid to upper slopes at lower elevations on the east side.

## 4103 - Sierra Juniper/Big Sagebrush Association (Zone 7)

***Juniperus occidentalis var. australis/Artemesia tridentata* Association**

Note: Aggregated to type 4100 (Alliance level) in PIFinal field

Several examples noted during the field reconnaissance. Observed in Lee Vining Canyon and Robinson Creek (Twin Lakes) canyon. Sierra juniper and big sagebrush at higher elevations. No singleleaf pinyon or curl-leaf mountain mahogany present.



**4103 – Sierra Juniper / Big Sagebrush Association**

A rather dense stand is depicted here above Lee Vining; the only juniper type not associated with a sclerophyl shrub understory.

Taxa – Partial listing below, see Potter (1998) for complete listing. (Potter sample sixe = 17). Tree cover is 4-75%, averaging 31%.

| | Cons | Cover |
|---|---|---|
| Tree Overstory | | |
| Sierra juniper | 100 | 16 |
| Jeffrey pine | 53 | 10 |
| California red fir | 41 | 8 |
| Western white pine | 29 | 5 |
| Sierra lodgepole pine | 24 | 16 |
| Tree Understory | | |
| Sierra juniper | 59 | 1 |
| California red fir | 41 | 2 |
| Jeffrey pine | 35 | 1 |
| Sierra lodgepole pine | 24 | 1 |
| Shrubs | | |
| Big sagebrush | 100 | 16 |
| Wax currant | 41 | 4 |
| Parish's snowberry | 41 | 8 |
| Whitethorn ceanothus | 35 | 8 |

Microclimate – Xeric
Elevation – 7600-8720 feet, average 8117 feet, Zone 7
Soil – 26" average, minimal and very rocky
Aspect – SE, SW
Shape – Convex
Slope Position – Generally middle to upper slopes
Steepness – 8-42% average 26%, steep
Hydrology – Upland
Frequency – Uncommon or rare

Note, the following similar map units can be confused with this type:

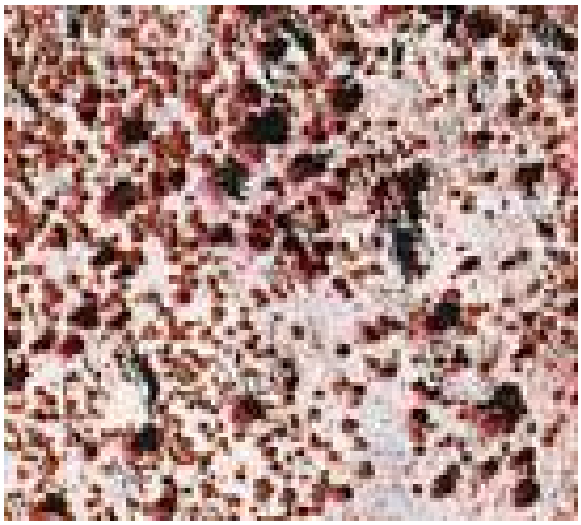
- Sierra Juniper/Curl-leaf Mountain Mahogany-(Big Sagebrush) Association (4107) – contains curl-leaf mountain mahogany component, and generally occurs in a slightly more mesic setting and at lower elevations. May contain singleleaf pinyon.

- Sierra Juniper Association & Sierra Juniper/Oceanspray Superassociation (4101) – occurs on upper slopes and granite domes.

Key Photo Signature Notes: Mainly an eastside type; look for presence of big sagebrush communities adjacent to the stand. Note absence of montane chaparral signature in understory.

### 4107 - Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland Association (Zone 8)

***Juniperus occidentalis var. australis-Cercocarpus ledifolius/Artemesia tridentata* Woodland Association**



**4107 – Sierra Juniper - Curl-leaf Mountain Mahogany/Big Sagebrush Association**

An eastside type with little or no montane chaparral; replaced by curl-leaf mountain mahogany. In this example, mountain mahogany is the smaller brown shrub understory.

Probably the most frequently occurring juniper type on the eastside. Observed in most major canyons, especially Lee Vining Canyon.

Taxa – Sierra juniper and curl-leaf mountain mahogany co-dominate in sparse to moderately dense stands with at least 10% relative cover of each species. Shrub understory layer of big sagebrush and antelope bitterbrush present but usually sparse. Singleleaf pinyon may be a minor component in the canopy.
Microclimate – Xeric
Elevation – Upper portions of Zone 8 and lower portions of Zone 7
Soil – Minimal and rocky
Aspect – Southerly
Shape – Convex
Slope Position – Generally mid to upper slopes
Steepness – Steep
Hydrology – Upland
Frequency – Fairly common, stands are sometimes extensive

Note, the following similar map units can be confused with this type:

- Sierra Juniper/Big Sagebrush Association (4103) – occurs at higher elevations possibly in areas of somewhat better soil development.
- Sierra Juniper & Sierra Juniper/Ocean Spray Superassociation (4101) – occurs on upper slopes and granite domes generally west of the crest.

## 4110 - Incense-cedar Forest Alliance (Zone 2)

***Calocedrus decurrens* Forest Alliance**

### 4111 - Incense-cedar-White Alder Forest Association (Zone 2)

***Calocedrus decurrens-Alnus rhombifolia* Forest Association**

Observed in Zone 2 in riparian settings associated with perennial streams.

Taxa – A minimum of 10% relative cover of white alder in association with other conifers; primarily incense-cedar.
Microclimate – Mesic
Elevation – Zone 2
Soil – Fairly well developed
Aspect – Variable
Shape – Concave
Slope Position – Lower slope streamside
Steepness – Moderately steep to slightly steep
Hydrology – Riparian to temporarily flooded
Frequency – Uncommon as a mapping unit wide enough to delineate

**4111 – Incense-cedar-White Alder Forest Association**
This example is running through the center of the image in a southwest to northeasterly direction. Stands are often too narrow to map.

Note, the following similar map units can be confused with this type:

- Douglas-fir-White Alder Association (4014) – is generally associated with adjacent Douglas-fir-ponderosa pine-incense-cedar association (4013).
- White Alder Alliance (2060) – has less than 10% conifer, and 4014 is found in narrower canyons.

Key Photo Signature Notes: Look for this type in watersheds large enough to support perennial streams generally in the lower mixed conifer belt. Most stands are in deeply incised non-glaciated narrow canyons that are too narrow to map.

## 4500 – 4900 - Superalliances and Alliance-level Forest Mapping Units

### 4510 - Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Forest Superalliance

***Pinus monticola-(Abies magnifica-Pinus contorta ssp. murrayana)* Forest Superalliance**

Note: Aggregation type including original PI Codes 3132, 4055 & 4057

A higher elevation mixed conifer aggregation type that contains western white pine.

Taxa – Western white pine is always in the stand, either as a co-dominant or dominant in the conifer canopy. In higher elevation sparse conifer stands, western white pine occasionally is a subordinate to Sierra lodgepole pine. California red fir and Sierra lodgepole pine may co-dominate stands in less severe settings.
Microclimate –Xeric to Sub Mesic
Elevation – Zones 4
Aspect – Variable
Shape – Variable
Slope Position – Lower to upper
Steepness – Nearly level to moderately steep
Hydrology – Upland
Frequency – Very common and extensively mapped high elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- Xeric Sierra lodgepole pine stands
- Rather open mixed red & white fir stands

Key Photo Signature Notes: This is a broad aggregation designed to encompass the varying cover amounts of other mixed conifers (primarily California red fir and Sierra lodgepole pine) to the western white pine. Most lower elevation stands are a woodland containing California red fir; higher elevation stands tend to be more open and contain more western white pine and less California red fir. Sierra lodgepole pine trends in areas that are generally less steep.

### 4520 - White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/ (Pinemat Manzanita-Whitethorn Ceanothus) Forest Mapping Unit (Zones 3 & 4)

***Abies concolor-(Abies magnifica Pinus lambertiana-Pinus jeffreyi) /( Arctostaphylos nevadensis-Ceanothus cordulatus)* Forest Mapping Unit**

Note: Aggregation type including original PI Codes 4054 & 4084

A lower to middle elevation mixed conifer type dominated by white fir, usually over an extensive montane chaparral understory.

Taxa – White fir dominates the conifer overstory, in varying amounts depending primarily on fire history. Shrub understory increases in areas that are more recently burned, especially stands

of pure whitethorn ceanothus. Higher elevation stands may have a component of pinemat manzanita or bush chinquapin with some California red fir in the overstory. Drier, rockier stands often contain a component of Jeffrey pine, while lower elevation stands will tend to have more sugar pine.
Microclimate –Xeric to Sub Mesic
Elevation – Zones 3
Aspect – Variable
Shape – Variable
Slope Position – Lower to upper
Steepness – Moderate to rather steep
Hydrology – Upland
Frequency – Very common and extensively mapped lower to mid elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- Mixed fir stands with a pine component
- White fir stands with little or no shrub understory

Key Photo Signature Notes: This type is a white fir aggregation that photointerpreters can reliably interpret white fir dominating the conifer overstory, often relying on a slightly narrower crown, more crown die-off and a slightly brighter CIR signature than the similar California red fir. Pines (especially sugar and Jeffrey) are often co-dominants and are detectable in more open settings where their crowns have a distinctive shape. Sugar pines, with their star-shaped crown, and Jeffrey pines, with their large rounded crowns, are often easy to identify at these diagnostic elevations.

## 4530 - White Fir-Sugar Pine-(Incense-cedar-Jeffrey Pine) Mapping Unit (Zone 3)

***Abies concolor-Pinus lambertiana-(Calocedrus decurrens-Pinus Jeffreyi)* Mapping Unit**

Note: Aggregation type including original PI Codes 3086, 4080, 4081, 4090, & 4094

Taxa – White fir usually dominates the stand, with sugar pine as an important component and occasionally co-dominant conifer. Sugar pine can locally dominate over small areas (e.g. Rockefeller Grove). In more mesic areas, incense-cedar can be a component to the conifer cover, with Jeffrey pine occurring in stands that trend more xeric. Most stands are a dense woodland or forest. Shrub understory varies from minimal to irregular in the stand, but is generally not visible on the aerial photography due to the dense tree cover.
Microclimate – Sub Mesic
Elevation – Zones 3
Aspect – Variable
Shape – Variable
Slope Position – Mid to upper
Steepness – Moderate to rather steep
Hydrology – Upland
Fire – Moderately frequent, likely to result in higher understory cover of deerbrush, littleleaf ceanothus, or other shrubs

Frequency – Very common and extensively mapped lower to mid elevation mixed conifer aggregate

Note, the following similar map units can be confused with this type:

- Mixed fir stands with a pine component (especially sugar pine)
- Pure stands of white fir
- Lower elevation stands where ponderosa pine dominates slightly over sugar pine also with a component of white fir.

Key Photo Signature Notes: A lower elevation mixed conifer type created to avoid subtle variations in conifer species dominance of sugar pine, white fir and Jeffrey pine. Stands often occur in conifer densities greater than 60%, often over extensive areas, and species relative cover estimates are difficult to ascertain in these settings.

## 4550 - Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit (Zone 2)

***Pseudotsuga menziesii-(Abies concolor-Calocedrus decurrens-Pinus ponderosa)* Forest Mapping Unit**

Note: Aggregation type including original PI Codes 4011 & 4013

A lower elevation mixed conifer aggregate of predominantly Douglas-fir.

Taxa – Douglas-fir dominates the stand in most settings with a co-dominance or subordinate amounts of other lower elevation conifers including ponderosa pine, incense-cedar and/or white fir. Stands are generally dense in forest settings, fire suppression often yielding dense sub canopy trees.
Microclimate –Sub Mesic to mesic
Elevation – Zones 2 to lower portions of zone 3
Aspect – Usually northerly except in concavities and draws
Shape – Variable
Slope Position –Variable
Steepness – Variable
Hydrology – Upland
Frequency – Uncommon for lower mixed conifer communities.

Note, the following similar map units can be confused with this type:

- Ponderosa pine – incense-cedar types
- Stands containing sugar pine

Key Photo Signature Notes: A mesic lower mixed conifer aggregation that yields a significant CIR signature from the presence of the Douglas-fir. Generally a brighter red than other lower elevation mixed conifers.

# 5000 - Evergreen Shrubs

## 5010 - Birchleaf Mountain Mahogany Shrubland Alliance (Zone 1)

***Cercocarpus montanus var. glaber* Shrubland Alliance**

Note: Aggregated to type 5580 in PIFinal field

Small examples of this type were seen in the upper portions of Zone 1 usually in association with the encroachment of drier chaparral species. It may not be possible to correlate the signatures gathered from the limited extent of this type. Largest examples noted on steep south facing slopes above Wawona.

**5010 – Birchleaf Mountain Mahogany Shrubland Alliance**

Uncommon as mappable stands in the study area; this example occurs with a significant component of whiteleaf manzanita. The birchleaf is the darker shrub in this image.

Taxa – Birchleaf Mountain Mahogany dominant (at least 20% as an emergent) in association with other mesic chaparral species (Northern Mixed Chaparral) or in drier rockier settings where it may co-occur with whiteleaf manzanita (steep slopes above Wawona).
Microclimate – Xeric to mesic
Elevation – Upper portions of Zone 1 and zone 2 to 4500 feet
Soil – Shallow, rocky
Aspect – Northerly
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Moderately steep
Geology – n/a
Hydrology – Upland
Fire – Post fire examples in association with whiteleaf manzanita noted on south facing slopes north of Wawona.
Frequency – Uncommon to rare and restricted in size

Note, the following similar map units can be confused with this type:

- Whiteleaf Manzanita Alliance (5070) in post burn settings has a similar color and texture but may occupy slightly more xeric settings.

## 5020 - Chamise Shrubland Alliance (Zone 1)

***Adenostoma fasciculatum* Shrubland Alliance**

### 5021 - Chamise Shrubland Association (Zone 1)

***Adenostoma fasciculatum* Shrubland Association**

**5021 – Chamise Shrubland Association**

This example represents several post-burn periods; overall, the image is pure chamise except for small inclusions of wedge leaf ceanothus in the upper right portion of the image.

Observed in the lower elevations of Zone 1. Uncommon as an "association" or pure mapping unit, chamise appears to co-dominate with buckbrush more frequently. Pure stands of chamise were usually observed in slightly hotter environments such as side ridge tops and southwestern slopes off spur ridges and granitic intrusions. This is probably the hottest driest association within the Yosemite Park and environs.

Taxa – Chamise usually in dense stands but occasionally in fairly open settings in steeper slopes.
Microclimate – Extremely xeric
Elevation – Lower portions of Zone 1
Soil – Moderately well developed generally from a granitic base
Aspect – South to southwest
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Moderately steep to extremely steep
Geology – Often from a granitic parent material.
Hydrology – Upland
Fire – Recently burned stands of chamise yield a highly variable signature on the CIR photography. They are not the traditional color and texture that normally dense stands of chamise yield. Within 1 year of fire sites are dominated by fire-following annual or short-lived perennials. Chamise dominates within 3 years.
Frequency –Isolated to the hottest, driest and steepest sites

Note, the following similar map units can be confused with this type:

- Chamise-Buckbrush Association (5031) - where buckbrush falls below 25% may be difficult to detect on the aerial photography.
- Note that stands affected by recent burns result in signatures that are highly variable, but are still the same type. Fire history maps will assist in correlating the variation of signatures within this and other chaparral types.
- Chamise-Whiteleaf Manzanita Association (5022) is found on upper spurs and ridgelines and less often on sideslopes.

Key Photo Signature Notes: Map where photo signature appears uniform; depending or criteria for association level mapping, it may be necessary to convert this mapping unit to a chamise alliance. Overall signature is uniform and smooth trending towards the mid browns (whiteleaf manzanita trending to the oranges and buckbrush trending towards the pinks)

## 5022 - Chamise-Whiteleaf Manzanita Association (Zone1)

***Adenostoma fasciculatum/Arctostaphylos viscida* Shrubland Association**

Note: Aggregated to type 5560 in PIFinal field

**5022 = Chamise – Whiteleaf Manzanita Association**

Upper slope example showing an even mix of the two species, the lighter-orange being the manzanita.

Observed on several slopes on both sides of the Merced River, generally the most upslope of the three types containing chamise. Overall this type also tends to be more limited in size, but is not confined to the most xeric sites.

Taxa – Chamise and whiteleaf manzanita co-dominant usually forming dense stands with at least 20% cover of each species.
Microclimate – Xeric
Elevation – Most portions of Zone 1
Soil – Less well developed than other types containing chamise (except pure chamise)
Aspect – Generally south but locally on drier side slopes off north facing ridges
Shape – Convex
Slope Position – Upper slopes and spurs
Steepness - Moderately steep to steep, but less steep than pure chamise
Hydrology – Upland
Fire – Takes longer to develop typical species composition following fire because whiteleaf manzanita is an obligate seeder and grows more slowly than chamise >5 years after fire.
Frequency – Fairly common

Note, the following similar map units can be confused with this type:

- Chamise-Buckbrush Association (5031) - probably tends to occur on lower slope positions. Buckbrush has a less distinct crown than whiteleaf manzanita.
- Chamise Association (5021) has a more uniform signature and occurs more on side slopes often below this type.

Key Photo Signature Notes: Note the rounded defined crown of the manzanita, especially in stands that have not burned recently contrasting with the diffuse and undefined crown of the chamise.

## 5030 - Chamise-Buckbrush Shrubland Alliance (Zone1)

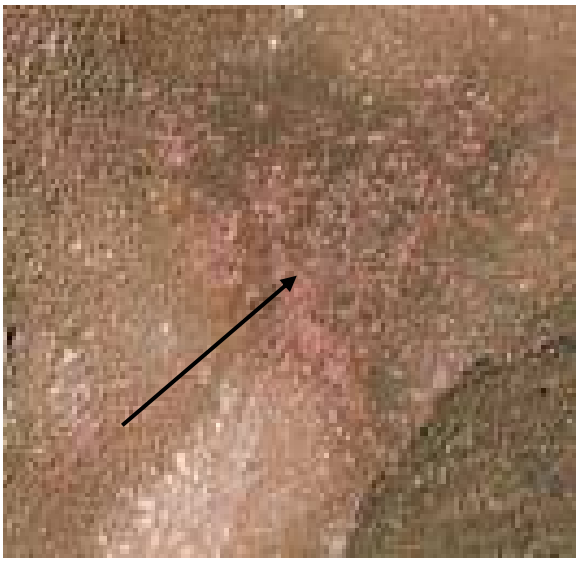
***Adenostoma fasciculatum-Ceanothus cuneatus* Shrubland Alliance**

Note: Although still in classification as a place holder, aggregated to type 5560 in PIFinal field

## 5031 - Chamise-Buckbrush Association (Zone 1)

***Adenostoma fasciculatum-Ceanothus cuneatus* Shrubland Association**

Note: Aggregated to type 5560 in PIFinal field



**5031 = Chamise – Buckbrush Association**

In this example, chamise represents approximately 70% relative cover. The pinker signature is the co-occurring buckbrush.

Frequently observed on major south-facing ridges above the Merced River and locally on drier north-trending ridgelines on the opposite side. Stands can be quite extensive and either species can dominate. Tends to be not quite as xeric as pure stands of chamise.

Taxa – Chamise and buckbrush co-dominate as dense stands with a minimum of 20% of each type required.
Microclimate – Xeric
Elevation – Most of Zone 1
Soil – Moderately well developed
Aspect – Generally south-facing slopes, locally on the upper portions of drier western side slopes off major northerly expressions also.
Shape – Convex
Slope Position – Mid and upper slopes
Steepness - Moderately steep
Geology – Often granitic parent material
Hydrology – Upland
Fire – Recently burned stands of chamise yield a highly variable signature on the CIR photography. They are not the traditional color and texture that normally dense stands of chamise yield.

Note, the following similar map units can be confused with this type:

- Chamise Association (5021) - occurs in slightly hotter slopes and has a more uniform signature due to the dominance of a single chaparral species. Pure chamise also occupies steeper and drier southerly exposures
- Chamise–Whiteleaf Manzanita Association (5022) - has a similar signature, however Manzanita crown is usually more distinct and overall chamise-whiteleaf manzanita association is slightly higher in elevation.

Key Photo Signature Notes: Note this type contains two species of shrubs where crowns are not well defined (such as in whiteleaf manzanita); this tends to yield an overall smooth signature with variable color contrasts depending on environmental and aerial photo constraints. Best case scenarios yield a distinct color difference between the two species (chamise trending brown and buckbrush trending pink)

## 5040 - Interior Live Oak Shrubland Alliance (Zone 1)

***Quercus wislizenii* Shrubland Alliance**

Note: Although still in classification as a place holder, aggregated to type 1530 in PIFinal field

### 5041 - Interior Live Oak-California Buckeye Shrubland Association (Zone 1)

***Quercus wislizenii - Aesculus californica* Shrubland Association**

Note: The interior live oak-California buckeye shrubland association is not recognized in the vegetation classification under interior live oak shrubland alliance.

Observed frequently on extremely steep and rocky environments throughout most of Zone 1 in stands that tend to be rather open. This type was easy to observe at the time of the reconnaissance because of the new leaf conditions of the California buckeye; August photography yields a late leaf period of summer drought. California buckeye leaves are senescing in August.

**5041 – Interior Live Oak – California Buckeye Shrubland Association**

Not separable from type 1501 except by elevation occurring in similar rocky steep settings. This example was taken below 2000 feet elevation. The buckeye has a yellow signature.

Taxa – Moderately open to open stands of interior live oak and California buckeye with a minimum of (10%) cover for each type.
Microclimate –Xeric
Elevation – Most portions of Zone 1
Soil – Poorly developed and rocky however not as extreme as pure stands of chamise
Aspect – Variable but not northerly
Shape – Variable
Slope Position – Mid and upper slopes
Steepness - Steep to extremely steep
Fire – Could occur as dominant type within 5 years following fire because both interior live oak and California buckeye resprout from root crown.
Frequency – Common, stands usually not very extensive

Note, the following similar map units can be confused with this type:

- Open stands of the chamise association may appear similar to this type, but probably are not quite as rocky; however chamise will occur on steeper sites with poorer soils. Note possible textural differences on the CIR.
- Stands of California buckeye above 2000-2500 feet should be placed into the canyon live oak/California buckeye & interior live oak-California buckeye superalliance (1501).

Key Photo Signature Notes: Look for yellowish signature of the late senescing leaves of the California buckeye against a steep rocky setting co-occurring with the pink signature of the interior live oak.

## 5050 - Buckbrush Shrubland Alliance (Zone 1)

***Ceanothus cuneatus* Shrubland Alliance**

Note: Aggregated to type 5580 in PIFinal field

Pure stands of buckbrush are rare in the study area, observed primarily at upper most slopes along Foresta Road that were not extremely steep. Other areas were observed throughout the higher portions of Zone 1, but were limited in size. Photo signature has not adequately been established to accurately separate out this type from other low elevation chaparral types.

Taxa – Buckbrush dominant with less than (40%) occurrence of other chaparral species
Microclimate – Xeric to dry mesic
Elevation – Higher portions of Zone 1
Soil – Moderately well developed
Aspect – Generally southerly but not extreme
Shape – Convex
Slope Position – Upper slopes
Steepness - Moderately steep
Hydrology – Upland
Fire – Obligate seeder following fire but seed survives fire in soil seedbank. Fire frequency estimated at 30 to 60 years. Community burns hot and extensively. Forms initial community following fire, probably within a couple of years.
Frequency – Uncommon as extensive pure stands, more frequent over small areas

Note, the following similar map units can be confused with this type:

- Whiteleaf Manzanita Alliance ((5070) - may at times appear similar, but usually occurs at higher elevations and on ridgelines. Whiteleaf crown is more rounded and defined.

Key Photo Signature Notes: Not established in the environs

## 5060 - Chaparral Whitethorn Shrubland Alliance (Zone 1)

***Ceanothus leucodermis* Shrubland Alliance**

Noted on gentle upper slopes off Foresta Road around 3500 feet elevation. Based on one plot site, photo signature not adequately established.

Taxa – Chaparral whitethorn dominant with less than 40% relative cover of other chaparral species.
Microclimate - Xeric
Elevation – Zone 1 to lower end of Zone 2
Soil – Moderately to poorly developed
Aspect - Southerly
Shape - Convex
Slope Position – Mid to upper slopes
Steepness – Moderately steep to gentle terrain

Note darker patches of vegetation south of the road

Hydrology - Upland
Fire – Short-lived shrub, depends on fire for establishment. Community disappears within 40 to 70 years without fire. There are 30 to 60 year fire frequencies in central California. Highly flammable but resprouts and germinates from seed following (typically large scale) fires.
Frequency – Infrequent within mapping area

Note, the following similar map units can be confused with this type:

Key Photo Signature Notes: Photo signature not established in the environs

## 5070 - Whiteleaf Manzanita Shrubland Alliance (Zone 1)

***Arctostaphylos viscida* Shrubland Alliance**

Note: Aggregated to type 5580 in PIFinal field

**5070 = Whiteleaf Manzanita Alliance**

A nearly pure stand of manzanita yielding an orange signature. Several oaks are scattered throughout this example.

Observed frequently throughout Zone 1 and portions of Zone 2 in several different settings, one associated with post burn recovery. Noted as a post burn recovery species in the Arch Rock 1990 Burn area along Foresta Road.

Taxa – Dense stands of whiteleaf manzanita in Zone 1 with less than 40% of other chaparral species; moderately open to dense stands in Zone 2 as post burn recovery species
Microclimate – Xeric to dry mesic
Elevation – Upper portions of Zone 1 and throughout Zone 2 in xeric upper slope settings
Soil – Moderately well developed
Aspect – Variable
Shape – Convex
Slope Position – Ridge tops and tops of spurs off main ridges in Zone 1
Steepness - Moderately to fairly steep in Zone 1 frequently occupying ridge tops and the tops of spurs off main ridges. Variable in Zone 2 burn areas.
Hydrology – Upland
Fire – Extensive stands in post burn environments
Frequency – Fairly common as fire recovery species, and fairly common but limited in extent in Zone 1

Note, the following similar map units can be confused with this type:

- Buckbrush Alliance (5050) - In Zone 1, occupies slightly lower and somewhat more xeric expressions. However buckbrush has more diffuse crown and generally occurs on lower slope.
- Chamise-Whiteleaf Manzanita (5022) - usually occurs at lower elevations and more often off ridgelines and spurs.

Key Photo Signature Notes: Texture is more hummocky than other low elevation chaparral stands reflecting the often distinct crown of the manzanita. Signatures yield a generally orange color in most stands.

## 5080 - Bush Chinquapin Shrubland Alliance (Zones 3 & 4)

***Chrysolepis sempervirens* Shrubland Alliance**

Note: Aggregated to type 5570 in PIFinal field

Taxa – Bush chinquapin of at least 5-25% cover. Bitter cherry and/or spreading dogbane may be present. Bracken fern is a common component.
Microclimate – Subxeric
Elevation – 7000 to 8000 feet
Soil – Shallow, rocky
Aspect – Variable
Shape – Convex
Slope Position – Mid (to upper) slopes
Steepness – Slight to moderate
Geology – Granitic
Hydrology – Upland
Frequency – Rare, more typically bush chinquapin is an understory component to conifers such as California red fir or western white pine

Note, the following similar map units can be confused with this type:

- Huckleberry Oak Alliance (5100) is indistinguishable from bush chinquapin; both yielding a bright red signature.

Key Photo Signature Notes: Generally not distinguishable from huckleberry oak in most settings.

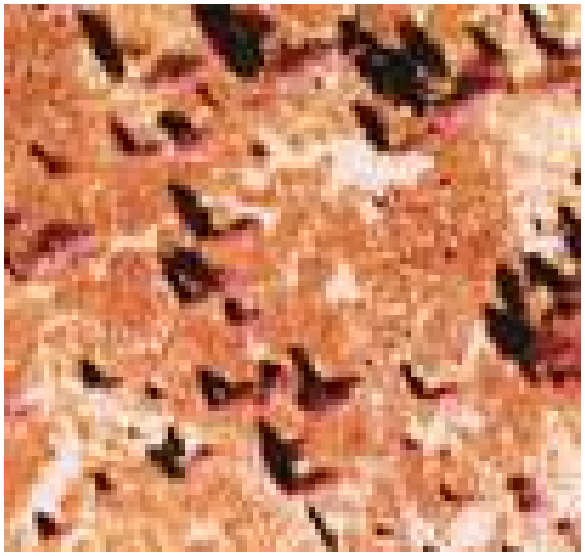
## 5090 - Greenleaf Manzanita Shrubland Alliance (Zone 3)

***Arctostaphylos patula* Shrubland Alliance**

Note: Aggregated to type 5570 in PIFinal field

Small stands observed on the Fire Lookout Road west of Crane Flats, on Big Sandy Road at the 5300 foot level and on Forest Service Roads south of the Park between 5800 and 6800 feet.

Taxa – Greenleaf manzanita in open to moderately dense stands. Other shrubs are common associates including whitethorn ceanothus, bush chinquapin, and pinemat manzanita. huckleberry oak often occurs with this association but should be no more than 5% relative cover.
Microclimate – Xeric
Elevation – 5000–7000 feet
Aspect – SW, SE, S
Shape – Convex
Slope Position – Mid to upper slopes
Steepness – Moderate to steep
Hydrology – Upland
Frequency – Uncommon and usually fairly small in size



**5090 – Greenleaf Manzanita Shrubland Alliance**

Greenleaf manzanita in this stand is on a rocky setting about 6000 feet in elevation. This species generally yields a darker signature than whiteleaf manzanita. This example transitions to type 3072 (with Jeffrey pine sparse overstory).

Note, the following similar map units can be confused with this type:

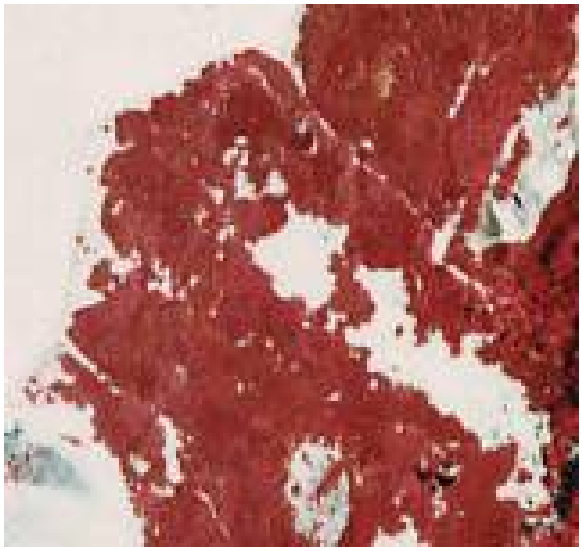
- Huckleberry Oak-Greenleaf Manzanita Association (5101) - contains a significant component of greenleaf manzanita, often individuals are in close proximity and are impossible to distinguish from the aerial photography. in general, however, the greenleaf manzanita alliance is found at lower elevations at YOSE.
- Whiteleaf Manzanita Alliance (5022) is found at lower elevations more often associated with ponderosa pine than Jeffrey pine.

Key Photo Signature Notes: Greenleaf manzanita yields a signature intermediate in color between whiteleaf manzanita (light orange) and huckleberry oak (usually bright red)

## 5100 - Huckleberry Oak Shrubland Alliance (Zone 3)

***Quercus vaccinifolia* Shrubland Alliance**

Note: Aggregated to type 5570 in PIFinal field



**5100 – Huckleberry Oak Alliance**

Shrub cover ranges widely in this type; this example being a pure dense stand in the upper Yosemite Valley.

Frequently observed during field reconnaissance at elevations over 6500 feet along the Glacier Point Road and Tioga Road on post glacial rocky areas.

Taxa – Open to extremely dense stands of huckleberry oak, often in association with other shrubs such as greenleaf manzanita and/or bush chinquapin.
Microclimate –
Elevation – 6500–9000 feet
Aspect – SW, SE, S ; can trend northerly at lower elevations on domes and glacial rock
Shape – Convex
Slope Position – Mid to upper slopes
Steepness – Moderate to steep
Hydrology – Upland
Frequency – Common on domes and in association with sparse Jeffrey pine

Note, the following similar map units can be confused with this type:

- Greenleaf Manzanita Alliance (5090) - is usually found at lower elevations, greenleaf manzanita can be a substantial component to the huckleberry oak alliance.
- Jeffrey Pine/Huckleberry Oak Association (3075) generally has at least a 5-10% emergent cover of conifers.

Key Photo Signature Notes: Note the bright red signature of the huckleberry oak – generally not associated with recent burn. Map polygons as this type where stands are dense with a sparse conifer overstory of below 5-10%.

## 5101 - Huckleberry Oak-Greenleaf Manzanita Association (Zone 3)

***Quercus vaccinifolia-Arctostaphylos patula* Association**

Note: Aggregated to type 5570 in original PI field

Taxa – Huckleberry oak and greenleaf manzanita co-dominating with at least 10-20% relative cover of each species. Other montane shrub species (bitter cherry, whitethorn ceanothus) may be locally important in patches depending on fire history or proximity to small rivulets and draws.
Microclimate – Xeric
Elevation – Zone 3
Aspect – Generally Southerly (southeast to southwest).

Shape – Neutral to convex
Slope Position – Mid to upper – often on extended exposed sideslopes
Steepness – Moderately steep to steep
Hydrology – Upland
Frequency – Common as a co-dominant shrub in xeric settings

Note, the following similar map units can be confused with this type:

- Huckleberry Oak Alliance has less variability in signature reflecting the dominance of one shrub species.

Key Photo Signature Notes: It is extremely difficult to map small patches accurately to type 5100 or 5101. Look for signature variability within the mapped stand (generally oranges and reds mixing)

**5101 – Huckleberry Oak – Greenleaf Manzanita Association**

A common co-dominating shrub, this example contains approximately 45% relative cover of each species plus minor patches of whitethorn ceanothus in the upper left corner.

## 5110 - Whitethorn Ceanothus Shrubland Alliance (Zone 3)

***Ceanothus cordulatus* Shrubland Alliance**

Taxa –Whitethorn ceanothus usually in dense stands; other shrubs often a component including bitter cherry in local draws, fuchsia-flowered gooseberry on slopes. Often associated with canopy openings of white fir in post-burn communities.
Microclimate – Mesic
Elevation – Zone 3, 5500–7000 feet, commonly occurring after burns in California red fir and mixed fir forests
Soil – Well developed
Aspect – Variable
Shape – Convex
Slope Position – Mid and upper slopes
Steepness – Moderate to steep
Hydrology – Upland
Fire – Post burn community where white fir or California red fir removed by fire
Frequency – Frequent; dominates following high severity fire in California red fir forests

Note, the following similar map units can be confused with this type:

- Bitter Cherry Alliance (5220/6300) - has a pinker, “wetter” signature and is usually in draws.

- Greenleaf Manzanita Alliance (5090) – Greenleaf manzanita generally yields an orange signature.

Key Photo Signature Notes: Note the pink signature of the ceanothus (a common characteristic of the other west side ceanothus species in the park).

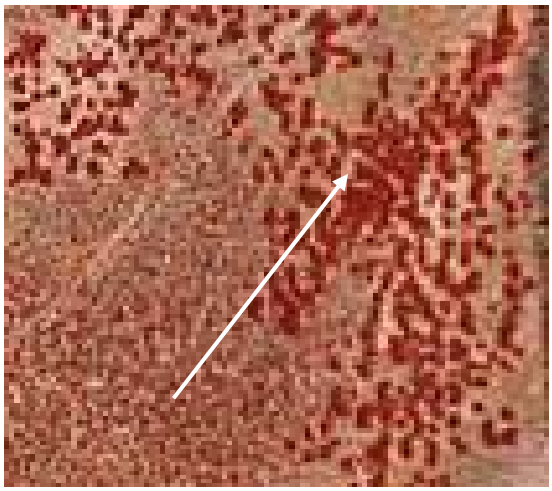
**5110 – Whitethorn Ceanothus Alliance**

In this example the stand is accompanied by a sparse fir overstory. Most examples of this alliance are shrub openings in a white fir or sugar pine forest.

## 5120 - Snowbrush Ceanothus Shrubland Alliance (Zones 7 & 8)

***Ceanothus velutinus* Shrubland Alliance**

Taxa – Moderately dense to dense shrub layer containing at least 25% cover snowbrush ceanothus co-dominating with a generally higher cover of big sagebrush. Antelope bitterbrush is generally not in the shrub canopy.
Elevation – 7500; locally to 10000 feet on some exposures
Aspect – Generally southerly but variable
Shape – Slightly concave
Slope Position – Mid to upper slopes
Steepness – Generally moderate
Hydrology – Upland
Frequency – Common



**5120 – Snowbrush Ceanothus Shrubland Alliance**

A good example along the Virginia Lakes Road where snowbrush ceanothus mixes with sagebrush. Snowbrush ceanothus shows up bright red on the imagery.

Note, the following similar map units can be confused with this type:

- Where snowbrush ceanothus becomes too sparse (below approximately 25%), this type should not be separated out as a distinct unit. Mapped as appropriate big sagebrush or antelope bitterbrush type.
- Big Sagebrush Alliance (5160) – may have sparse snowbrush ceanothus (below approximately 25%).

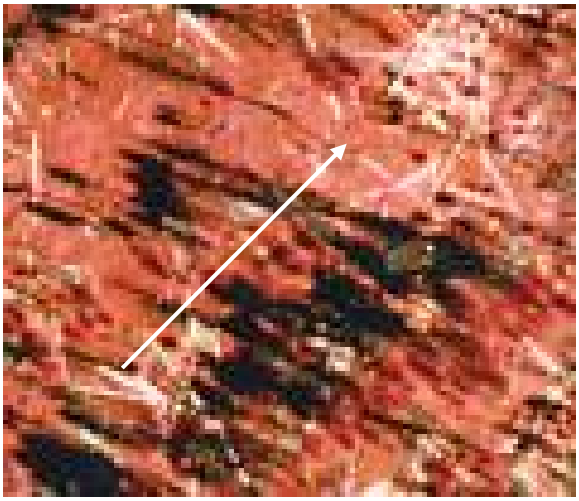
- Antelope Bitterbrush-Big Sagebrush-Snowberry Association (5243) – may have snowbrush ceanothus (approximately below 25% cover).
- Snowbrush ceanothus-Bitter Cherry Association (5121) – normally contains a significantly higher relative cover of snowbrush ceanothus.

Key Photo Signature Notes: Mapped in a variety of settings; lower elevation stands are more easily recognizable as the snowbrush ceanothus stands out from the associated sagebrush and bitterbrush. Higher elevation stands or ones in close proximity to rivulets or springs are often difficult to classify since bitter cherry and aspen are usually present in varying degrees in the area.

## 5130 - Mountain Misery Dwarf-shrubland Alliance (Zone 2)
***Chamaebatia foliolosa* Dwarf-shrubland Alliance**

Note: Aggregation type contains original PI Code 5131

### 5131 - Mountain Misery – Manzanita spp. Mapping Unit (Zone 2)
***Chamaebatia foliolosa – Arctostaphylos spp.* Mapping Unit**
Note: Aggregated to type 5130 in PIFinal field



**5131 – Mountain Misery – (Manzanita) Mapping Unit**

Generally limited in size to small post burn openings in the canopy as depicted in this image.

Stands of whiteleaf manzanita with an extensive understory of mountain misery were seen over large areas of the Arch Rock Burn.

Taxa – Open stands of mountain misery in dense or patchy locally dense settings with less than 5-10% overstory conifer cover. Often in situations with standing dead conifer snags. May occur with greenleaf or whiteleaf manzanita as an emergent shrub.
Microclimate – Submesic
Elevation – Zone 2
Soil – Moderately well developed
Aspect – Variable
Shape – Variable
Slope Position – Potentially all slope positions on sites where conifers were removed by fire
Steepness - Moderately steep to gentle terrain
Hydrology – Upland
Fire – Seen as a post-burn recovery type (1990 Arch Rock Fire). Within 5 years and up to 15-20 years following fire.
Frequency – Observed over extensive areas within the Arch Rock Burn

Note, the following similar map units can be confused with this type:

- Stands of mountain misery that co-occur with other post burn chaparral species may be difficult to classify. Stands with sparse post fire conifer reproduction may also be difficult to classify.

Key Photo Signature Notes: Signature is always very smooth; no height depicted from stereo photography. Openings are often too small to map and should be left as inclusions within conifer types such as 3061 or 3062.

## 5160 - Big Sagebrush Shrubland Alliance (Zones 7 & 8)
***Artemisia tridentata* Shrubland Alliance**

Note: Aggregation type including original PI Code 5163

Taxa – Stands of big sagebrush dominate. Antelope bitterbrush, desert gooseberry, or other shrubs can be a component, but generally below 10% relative cover.
Microclimate -
Elevation – Lower portions of Zone 7 and most of Zone 8
Soil – Well developed
Aspect – Variable
Shape – Neutral to concave
Slope Position – Lower slope positions in concavities and draws
Steepness – Slight to moderate
Hydrology – Upland
Frequency – Common but not extensive in size

**5160 – Big Sagebrush Shrubland Alliance**
Shown here transitioning to the drier 5240 types along the edges of the photo, sagebrush shows up as a brown to gray signature.

Note, the following similar map units can be confused with this type:

- Antelope Bitterbrush Superassociation (5244) - often contains antelope bitterbrush in relative densities generally over 30% cover. This density break can be difficult to determine, especially where antelope bitterbrush occurs primarily as small individual plants, making it hard to distinguish at times from big sagebrush.
- Antelope Bitterbrush-Big Sagebrush-Snowberry Association (5243) – often contain antelope bitterbrush in relative densities around 30% cover. The density break can be difficult to determine, especially where antelope bitterbrush occurs primarily as small individual plants, making it hard to distinguish at times from big sagebrush.
- Snowbrush Ceanothus Alliance (5120) - has significantly denser snowbrush ceanothus (greater than 25% cover).
- Mountain Sagebrush & Rothrock Sagebrush & Oceanspray Superalliance (5501) – is found at higher elevations along meadow edges and rocky outcroppings.

Key Photo Signature Notes: Generally mapped in more mesic settings than the antelope bitterbrush types. Also mapped at higher elevations in less rocky conditions west of the crest. Several stands are noted with whitebark pine.

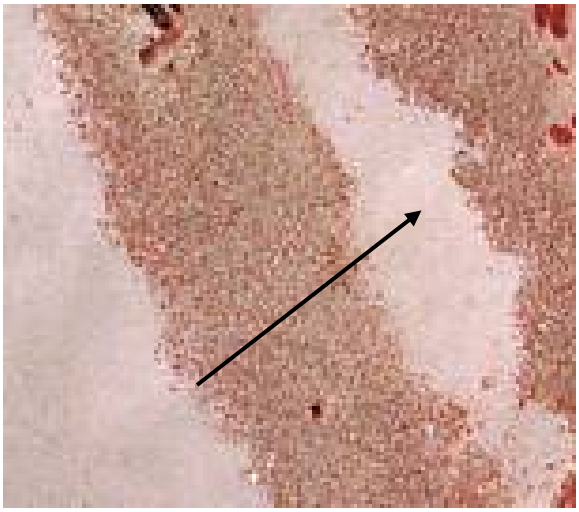
### 5163 - Big Sagebrush/Mountain Pennyroyal Shrubland Association (Zones 7 & 8)
***Artemesia tridentata/ Monardella odoratissima* Shrubland Association**

Note: Very rarely mapped in YOSE and aggregated into type 5160 (Alliance level) in PIFinal field.

## 5210 - Low Sagebrush Dwarf-shrubland Alliance (Zones 7 & 8)
***Artemesia arbuscula* Dwarf-shrubland Alliance**

Note: Aggregation type including types original PI types 5211 & 5212

### 5211 - Low Sagebrush – Slender Buckwheat Association
***Artemesia arbuscula - Eriogonum gracile* Association**
Note: Aggregated to type 5210 (Alliance level) in PIFinal field



**5211 – Low Sagebrush – Slender Buckwheat Association**

Shown here contrasting with type 5243, (the lighter signature being type 5211). Sharp contrasts such as this example are the rule with this low sagebrush type.

Observed during field reconnaissance on ridge tops and spurs below 9000 feet generally north of Conway Summit and along Green Creek Road below the Virginia Lakes cutoff.

Taxa – Low sagebrush as a sparse to moderately dense cover, big sagebrush may occur in relatively low densities and possibly may co-dominate. Muttongrass (*Poa fendleriana*) usually forms a sparse herbaceous layer. "Cushion" shrubs <0.5 dm. in height may also be present in the shrub layer.
Microclimate – Locally affected by severe winds that may cause additional stress to plants and may mimic higher elevation conditions.
Elevation – Upper portions of Zone 8
Soil – Gravelly, less developed soil than surrounding areas
Aspect – Variable
Shape – Convex
Slope Position – Ridgelines and spurs, sometimes side slopes
steepness – Moderate to steep
Hydrology – Upland
Fire – Rare
Frequency – Fairly common, local and usually small in extent

Note, the following similar map units can be confused with this type:

- Big Sagebrush Alliance (5160 ) – occurring as big sagebrush in natural disturbance (burns) is difficult to distinguish from 5211, but should be successfully delineated based on topography and fire disturbance patterns.
- Low Sagebrush–Leptodactylon Pungens Association (5212) - are generally found on higher elevations.

Key Photo Signature Notes: Note contrast to adjacent stands of big sagebrush (that yield a darker signature). Difficult at times in areas of post fire. Use of slope attributes is helpful.

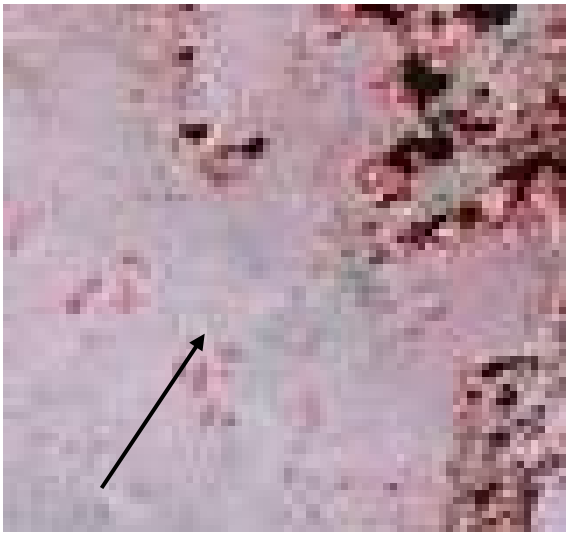
## 5212 - Low Sagebrush– Prickly Phlox Dwarf-Shrubland Association (Zone 7)

***Artemesia arbusculus- Leptodactylon Pungens* Association**

Note: Aggregated to type 5210 (Alliance level) in PIFinal field

Observed during the field reconnaissance above Conway Summit on Virginia Creek Road up to Big Virginia Lake at 10,100 feet.

Taxa – Low sagebrush dominates in sparse to moderate densities with an associated cushion plant community including prickly phlox, Lobb's buckwheat, alpine rabbitbrush, pygmy fleabane, goldenbush and others. Big sagebrush is generally not present.
Microclimate – Locally affected by severe wind and cold, depleting available moisture that may linger in adjacent draws.
Elevation – Generally above 10,000 feet, Zone 7



**5212 – Low Sagebrush / Prickly Phlox Dwarf-shrubland Association**

A subalpine sagebrush type; depicted here in a fairly dense setting near Virginia Lakes. Whitebark and Sierra lodgepole pine are noted in the right portion of the image.

Soil – Depleted, and gravelly
Aspect – Variable
Shape – Always convex
Slope Position – Ridgelines and spurs
Steepness – Moderate
Hydrology – Upland
Fire – Rare
Frequency – Common, but restricted in size

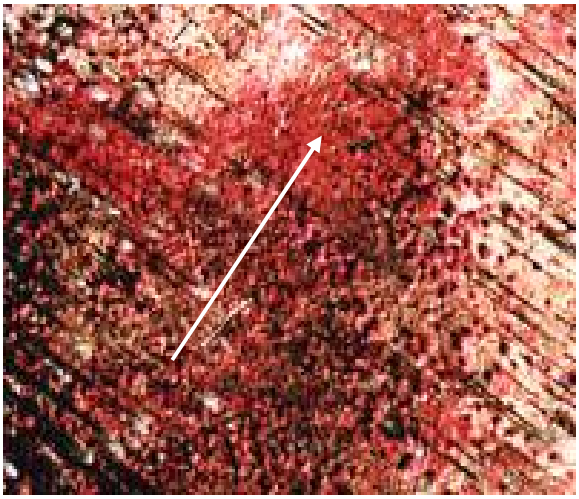
Note, the following similar map units can be confused with this type:

- Higher elevation true alpine "cushion" types
- Low Sagebrush/Poa Fendleriana Association (5211) – is generally found at lower elevations.
- Mountain sagebrush-Rothrock sagebrush-Oceanspray-Red Mountainheather mapping unit (5510) can be confused with this type but in most cases is found in rockier settings.

## 5220 - Bitter Cherry Shrubland Alliance (Zone 3)

***Prunus emarginata* Shrubland Alliance**

Note: Aggregated to type 6900 in PIFinal field



**5220 – Bitter Cherry Shrubland Alliance**

A post burn type, generally limited in extent, depicted here in a 10 year post burn towards the upper portion of the photo. (Bright red signature)

Small stands of bitter cherry were observed during field reconnaissance on the Fire Lookout Road and in mesic swales associated with larger stands of whitethorn ceanothus.

Taxa – Dense stands of bitter cherry noted in the "Steamboat Burn" with other mesic shrubs often an important component, such as deerbrush.
Microclimate – Mesic
Elevation – Zones 3 and 4, 4500–9000 feet, locally higher, but usually below MMU Also local on eastside.
Soil – Well developed
Aspect – Variable
Shape – Concave
Slope Position – Lower and mid slopes
Steepness – Moderate to steep
Hydrology – Riparian to mesic slopes
Fire – Often in post burn draws and swales
Frequency – Uncommon and mapping units fairly small

Note, the following similar map units can be confused with this type:

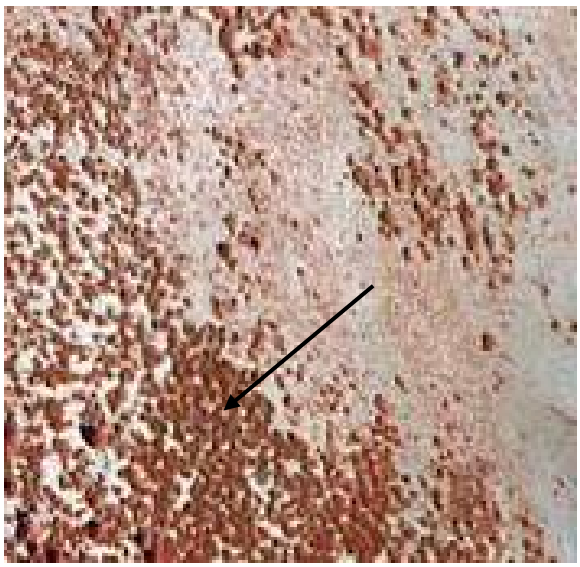
- Mesic stands of Whitethorn Ceanothus Alliance (5110) - Bitter cherry alliance photo signature is pinker, appears “wetter” and generally found adjacent to type 5110 but in local small drainages.

Key Photo Signature Notes: Eastside stands are also very small and the pink signature can be confused with low aspen, willow or snowbrush ceanothus.

## 5230 - Curl-leaf Mountain Mahogany Woodland Alliance (Zone 8)

***Cercocarpus ledifolius* Woodland Alliance**

Observed during the field reconnaissance in all canyons, in an extremely wide range of elevations, up to over 10,000 feet in some instances. Stands of dense curl-leaf mountain mahogany were observed in Lee Vining Canyon and small canyons to the north between Lee Vining and Lundy Lake.



**5230 – Curl-leaf Mountain Mahogany Woodland Alliance**
Shown here (larger dark brown shrubs) contrasting to type 5244. Stand densities vary considerably as depicted in this scene.

Taxa – Curl-leaf mountain mahogany in sparse to dense stands of at least 10% cover with an understory shrub layer usually present in the form of big sagebrush and antelope bitterbrush.
Microclimate – Highest elevational expressions undergo some wind pruning
Elevation – Middle portions of Zone 8 upward and including most of Zone 7
Soil – Rocky to well drained
Aspect – Highly variable, northerly at lower elevations becoming southerly at higher elevations
Shape – Neutral to convex, usually convex
Slope Position – Mid to upper slopes
Steepness – Moderate to steep, usually steep
Hydrology – Upland
Frequency – Very common, widespread and often in quite extensive stands

Note, the following similar map units can be confused with this type:

- Other Mesic Shrub Types - Higher elevation stands that are fairly dense and are sheared by cold and wind may be confused with other mesic shrub types including the snowbrush ceanothus alliance. At these elevations, curl-leaf mountain mahogany will occur on only the driest and warmest locations.
- Singleleaf Pinyon-Curl-leaf Mountain Mahogany/Big Sagebrush–Antelope Bitterbrush Association (3112) - occurs in similar environmental settings, but is much less common. Curl-leaf mountain mahogany co-dominates with singleleaf pinyon pine.

Key Photo Signature Notes: Whitebark pine/Davidson's penstemon stands occasionally are adjacent to this type at high elevations in somewhat more mesic settings and can be difficult to distinguish from the stunted curl-leaf mountain mahogany.

## 5240 - Antelope Bitterbrush Shrubland Alliance (Zones 7 & 8)

***Purshia tridentata* Shrubland Alliance**

Note: Aggregation type including types original PI types 5243 & 5244

### 5243 - Antelope Bitterbrush-Big Sagebrush-Snowberry Association

***Purshia tridentata – Artemesia tridentata-Symphocarpus* Association**

Note: Aggregated to type 5240 (Alliance level) in PIFinal field

**5243 – Antelope Bitterbrush – Big Sagebrush – Snowberry Association**

The higher elevation mesic expression when compared to type 5244; the brown is the sagebrush; red signature is bitterbrush and snowberry.

The highest and most mesic type within the antelope bitterbrush alliance. Mesic shrubs are often co-dominant with the antelope bitterbrush and big sagebrush.

Taxa –Antelope bitterbrush and big sagebrush co-dominate with mesic shrubs including snowberry, gooseberry. and/or bitter cherry. Big sagebrush is at least 30% cover but antelope bitterbrush is often only around 30% cover within this type.
Microclimate – Xeric
Elevation – Generally the lower to mid portions of Zone 7
Aspect – Variable depending on elevation; northeast and concave only at lowest elevations
Shape – Generally slightly concave
Slope Position – Lower to mid
Steepness – Moderate to steep
Hydrology – Upland
Frequency – Fairly common, and sometimes extensive

Note, the following similar map units can be confused with this type –

- Antelope Bitterbrush Superalliance (5244) - may be difficult to separate out from lower elevation examples of 5243 on the most northerly and concave slopes.
- Snowbrush Ceanothus-Bitter Cherry (5121) – has a higher relative cover of snowbrush ceanothus (above 25% cover).
- Big Sagebrush Alliance (5160) - often contains antelope bitterbrush in relative densities generally below 10% cover. This density break can be difficult to determine, especially where antelope bitterbrush occurs primarily as small individual plants, making it hard to distinguish at times from big sagebrush.

Key Photo Signature Notes: This type cannot be reliably differentiated from type 5244 on a small scale. Broad delineations have been attempted to get an overall distribution between types 5244 and 5243.

## 5244 - Antelope Bitterbrush Superassociation (Zone 8)

***Purshia tridentata* Superassociation**

Note: Aggregated to type 5240 (Alliance level) in PIFinal field

Associations:

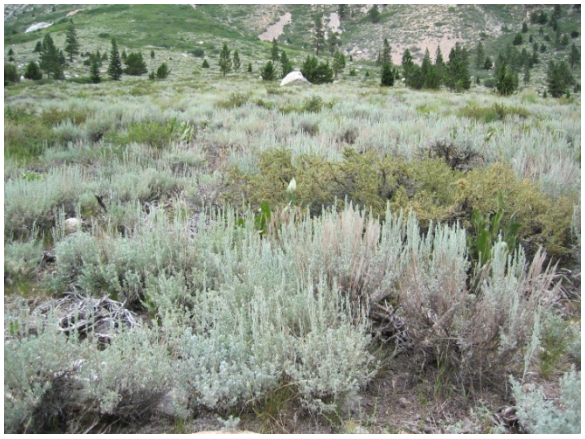
Antelope Bitterbrush-Big Sagebrush-Spineless Horsebrush Association
Antelope Bitterbrush-Big Sagebrush/Indian Ricegrass Association
Antelope Bitterbrush-Big Sagebrush/Nevada Needlegrass-(Dore's Needlegrass) Association
Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Association

The "near-desert" expression of this alliance was observed during the field reconnaissance generally east of the major canyons leading into the main range from US395. It is the hottest and driest community on the east side, occurring generally in areas receiving less than 15 inches of precipitation annually, with a growing season approaching 100 days.

Taxa – Moderately dense stands of tall big sagebrush and antelope bitterbrush in relative densities that vary considerably. Both species must contain at least 30% relative cover. Desert peach or spineless horsebrush is generally an indicator species at the lowest elevations. Great Basin wild rye usually occurs within the mapping unit as an extremely sparse to sparse herbaceous cover.

**5244 – Antelope Bitterbrush Superassociation**

A mapping class depicting a number of semi arid open shrublands dominated by antelope bitterbrush. The common co-dominant is big sagebrush with other species often present.



Microclimate – Dry semiarid moisture regimes (driest in the environs)
Elevation – Generally below 8000 feet, Zone 8
Soil – Sandy, well drained
Aspect – Variable
Shape – Trending convex
Slope Position – Alluvial side slopes and lowest hillsides
Geology – Often on morainal depositional non-consolidated rock
Hydrology –Well drained

Frequency – Common and widespread below 8000 feet

Note, the following similar map units can be confused with this type:

- Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Association (5243) – generally occurs on more mesic slopes on adjacent concavities, and has a somewhat brighter IR signature.
- Big Sagebrush Alliance (5160) - often contains antelope bitterbrush in relative densities generally below 10% cover. This density break can be difficult to determine, especially where antelope bitterbrush occurs primarily as small individual plants, making it hard to distinguish at times from big sagebrush

Key Photo Signature Notes: Not possible to separate out from type 5243 on a fine scale resolution. Generally the signature shows a shrub cover a bit more open and less diverse than the higher elevation 5243.

## 5250 - (Silver Lupine)/Brome spp. Shrubland Mapping Unit (Zone 1)

***(Lupinus albifrons)/Bromus spp.* Shrubland Mapping unit**

**5250 = (Silver Lupine)/Brome spp. Shrubland Mapping Unit**

Nearly impossible to separate out from bare rock or sparse herbaceous; the lupine, (upper center) at times is visible as a gray stipple pattern when stands are relatively dense.

Observed from a distance on extremely steep south-facing upper slopes in sparsely vegetated rocky environments.

Taxa – Silverbush lupine in open stands at a minimum of 5 to 10% cover as an emergent to California Annual Herbland/Grassland.
Microclimate – Xeric
Elevation – Mainly Zone 1
Soil – Minimal
Aspect – Southerly
Shape – Neutral
Slope Position – Upper slopes
Steepness – Extremely steep
Geology – Favors calcareous soils in the southern Sierra Nevada
Hydrology – Upland
Fire – No information available. Possibly occurs up to 10 years following disturbance including fire.
Frequency – Uncommon

Note, the following similar map units can be confused with this type:

- Unvegetated steep rocky cliffs may be inseparable from this sparsely vegetated type.

Key Photo Signature Notes: Photo signature not well established

## 5260 - Big sagebrush – (Silver Sagebrush) Shrubland Mapping Unit (Zone 8)

***Artemisia tridentata – (Artemesia cana)* Shrubland Mapping Unit**

Although this type may be common on drier meadow edges, it was only identified during the field reconnaissance in meadows north of Conway Summit. Several mappable examples containing silver sagebrush were noted at the edge of Upper Summers Meadow and the meadow complexes near Conway Summit.

Taxa – Silver sagebrush and or big sagebrush in sparse to moderately dense stands of at least 5% cover. Big sagebrush may co-dominate over a fairly dense herbaceous layer usually composed of baltic rush and or *Poa* spp.
Microclimate – Submesic
Elevation – Upper portions of Zone 8
Shape – Neutral
Slope Position – Meadow
Steepness – Flat
Hydrology – Temporarily flooded or saturated
Frequency – Uncommon (?), restricted in size, usually confined to the perimeters of the meadow

**5260 – Big sagebrush – (Silver Sagebrush) Shrubland Mapping Unit**

Mapped along meadow edges with minimal gradient on the eastside, depicted here with sparse sagebrush towards the left side of the image.

Note, the following similar map units can be confused with this type:

- Big Sagebrush Alliance (5160) - will be difficult to differentiate. Silver sagebrush is often difficult to see within the dense herbaceous layer that is usually the same height.

Key Photo Signature Notes: Map this type in meadows only to approximate the distribution of Silver Sagebrush

## 5280 - Pinemat Manzanita

Note: Aggregated to type 5570 in PIFinal field

This type was originally mapped in conjunction with existing Weislander (1937 era) polygons and extrapolated locally to stands with similar photo signatures. It has subsequently been aggregated and removed from the mapping classification. Polygons coded as 5280 can be found in the original PI field and are aggregated into type 5570 in the PIFinal field.

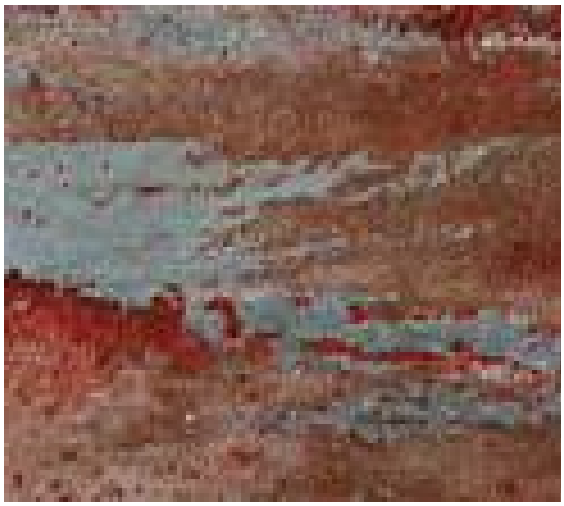
## 5500 - 5990 = Superalliances and Alliance-level Shrubland Mapping Units

### 5510 - Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance (Zones 4-7)

***Artemisia tridentata ssp. vaseyana* & *Artemisia rothrockii* & *Holodiscus discolor* and *Phyllodoce breweri* Shrubland Superalliance**

Noted on the drier fringes of meadows near Parker Pass in association with shorthair sedge.

Taxa – Sparse to occasional moderately dense stands of sagebrush (*Artemisia* spp.) or oceanspray (*Holodiscus* spp.) or Labrador tea (*Ledum* spp.) in variable settings, from dry meadow edges to rocky outcroppings.
Microclimate -
Elevation – Locally down to 8500 feet, more common above 9500 feet
Soil – Thin and poorly developed to rocky
Aspect – Variable
Shape – Trending convex
Slope Position – Generally mid to lower slopes
Steepness – Variable
Hydrology – Upland
Frequency – May be fairly common but stands often are below MMU



**5510 – Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance**

An alpine dwarf shrub mapping unit; this example depicts sagebrush mixing with inclusions of willow and talus.

Note, the following similar map units can be confused with this type:

- Dry Upland Meadows (7000s) - contain less texture and no visible crowns.
- Dry sub-alpine & alpine slopes on Scree (0200's) & Talus (0100's) - may contain other dwarf shrub species which are indistinguishable from sagebrush (*Artemisia* spp.)
- Rock Outcrops (0961) - contain little or no vegetation signatures.
- Big Sagebrush Alliance (5160) – is found at lower elevations, usually not on rocky outcroppings.

### 5560 - Chamise–(Buckbrush-Whiteleaf Manzanita) Shrubland Mapping Unit (Zone 1)

***Adenostoma fasciculatum-(Ceanothus cuneatus- Arctostaphylos viscida)* Shrubland Mapping Unit**

Note: Aggregation type including original PI Codes 5022, 5030 & 5031

A low elevation chaparral aggregation type that contains chamise.

Taxa – Chamise dominates the shrub layer; usually as a dense cover. Recent post fire settings tend to open the shrub canopy somewhat depending severity of the fire. More recent burns may tend to have a higher cover of buckbrush in the shrub layer. Stands closer to ridgelines and spurs tend to have a higher amount of whiteleaf manzanita.
Microclimate –Xeric
Elevation – Zones 1
Aspect – Mostly south to westerly
Shape – Convex
Slope Position – Mid to upper
Steepness – Moderate to rather steep
Hydrology – Upland
Fire – Fire is frequent. Chamise stump sprouts rapidly following fire; other dominant species regenerate from seed.
Frequency – Very common and extensively mapped low elevation chaparral aggregation

Note, the following similar map units can be confused with this type:

- More mesic low elevation chaparral communities dominated by Birchleaf Mountain Mahogany
- Stands where whiteleaf manzanita dominates adjacent to this type

Key Photo Signature Notes: It is extremely difficult to determine relative abundance of chamise and buckbrush (and also chamise and whiteleaf manzanita) when they co-occur, so this aggregation addresses situations where this co-dominance occurs.

## 5570 - Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Superalliance

***Arctostaphylos patula & Chrysolepis sempervirens & Quercus vaccinium* Shrubland Superalliance**

Note: Aggregation type including original PI Codes 5080, 5090, 5100, 5101 & 5280

A montane chaparral aggregation

Taxa – A broad aggregation of montane chaparral where any number of species (greenleaf manzanita, bush chinquapin or huckleberry oak) can dominate or co-dominate the shrub layer in sparse to dense settings. Emergent conifers are usually well below 10% cover.
Microclimate –Xeric
Elevation – Zones 4 & 7
Aspect – Variable but less common in north trending aspects
Shape – Convex
Slope Position – Mid to upper
Steepness – Moderate to rather steep
Hydrology – Upland

Frequency – Very common and extensively mapped montane chaparral aggregation

Note, the following similar map units can be confused with this type:

- Stands of montane chaparral where whitethorn ceanothus dominates the shrub layer
- Sparse conifer woodlands (10-20% cover) with a dense montane chaparral understory – especially common in Jeffrey pine and juniper types

Key Photo Signature Notes: A highly variable signature depending on the composition, age and density of the shrub layer. Variations in stand age (especially in recent post fire events) make it extremely difficult to determine relative species abundance on the aerial photography. This aggregation addresses these difficulties.

## 5580 - Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance

***Cercocarpus montanus var. glaber & Ceanothus cuneatus & Arctostaphylos viscida* Shrubland Superalliance**

Note: Aggregation type including original PI Codes 5010, 5050 & 5070

A low elevation mixed mesic chaparral also found in post burn settings. Roughly equates to Holland's "Northern Mixed Chaparral"

Taxa – In mesic north slope settings, birchleaf mountain mahogany dominates the shrub layer with varying amounts of other species, which may include California buckeye, chaparral ash, buckbrush, interior live oak, Oregon oak and California redbud. In post fire settings, whiteleaf manzanita (and other species including Indian manzanita) may dominate with a component of birchleaf mountain mahogany and possibly deerbrush.
Microclimate –Submesic
Elevation – Zones 1 and lower portions of zone 2
Aspect – Usually trending north except in post fire settings where it is variable
Shape – Concave except in post fire settings where it is variable
Slope Position – Mid to upper
Steepness – Moderate to rather steep
Hydrology – Upland
Frequency – Rare for the Yosemite environs; more extensive stands found further south in Sequoia National Park

Note, the following similar map units can be confused with this type:

- Stands low elevation chaparral where buckbrush and chamise dominate
- Post fire types including deerbrush dominated stands

Key Photo Signature Notes: A highly variable signature depending primarily on the species composition of the stand. Difficult to determine abundance since so many species may be an important component over such a small area.

# 6000 - Deciduous Shrubs

## 6010 - Deerbrush Shrubland Alliance (Zone 2)

***Ceanothus integerrimus* Shrubland Alliance**

Note: Stands of deerbrush were observed in the more mesic concave sites in the Arch Rock Burn area, and over more extensive areas as a recovery species in the higher elevation Steamboat Burn. A reliable signature could be construed in the burn areas only. Additional correlations are necessary to delineate this type in Zone 3.

**6010 – Deerbrush Shrubland Alliance**

Mapped where deerbrush is a dominant, often with other shrubs that may be difficult to identify. This example represents a small stand that is at least 80% relative cover.

Taxa – Deerbrush makes up over 70% of the relative shrub cover, often mixing with other shrub species including bitter cherry and manzanita species.
Microclimate - Submesic
Elevation – 3000 to 5000 feet in Zone 2
Soil – Well developed
Aspect - All
Shape – Neutral to convex
Slope Position – Mid to lower slopes
Steepness – Gentle to moderately steep
Geology – n/a
Hydrology - Upland
Fire – Dominates within 5 years of fire and until 20 years following fire.
Frequency – Fairly common (Steamboat 1990, Arch Rock 1990, Stanislaus complex 1987 fires)

Note, the following similar map units can be confused with this unit:

- Bitter Cherry Alliance (5220) yields an even redder signature, is also associated with post burn and is often adjacent to this type in small drainages.

Key Photo Signature Notes: Nearly impossible to separate out in post burn scenarios from bitter cherry which occupies somewhat more mesic settings.

### 6012 - Deerbrush-Whiteleaf Manzanita Shrubland Association (Zone 2)

***Ceanothus integerrimus - Arctostaphylos viscida* Shrubland Alliance**

Taxa – Deerbrush and whiteleaf manzanita each make up at least 20% relative cover;

**6012 – Deerbrush – Whiteleaf Manzanita Shrubland Association**

Post burn settings, the pinker component is the deerbrush, the orange being the manzanita. Several dead snags emerge from the dense shrub cover.

often in dense closed canopy stands.

Microclimate – Submesic to xeric
Elevation – 3000 to 5000 feet
Shape – Convex
Slope Position – Middle and upper slopes
Hydrology – Upland

Note, the following similar map units can be confused with this unit:

- 6010 – Deerbrush Alliance – Post burn stands of deerbrush with a mix of other species including emergent oak makes it difficult to fit the mapping unit to the association level.

## 6020 - Oregon White Oak Shrubland Alliance (Zone 1)

***Quercus garryana* Shrubland Alliance**

A fairly significant stand was seen south of the Cedar Lodge on the trail about half way up the slope. Currently there are not enough units observed of this type (if it occurs in other locations within the environs) to establish a reliable photo signature.

Taxa – Oregon white oak (=Brewer oak), in closed nearly pure stands
Microclimate – Mesic
Elevation – Zone 1
Soil – Moderately well developed
Aspect – North
Shape – Convex
Slope Position – Mid slope
Steepness – Moderately steep to steep
Hydrology – Upland
Fire – Not much information available on this variety or type
Frequency – Rare in environs

Note, the following similar map units can be confused with this type:

- Signature not established for this type.

## 6110 - Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance (Zones 4 & 5)

***Salix orestera/Allium validum* Seasonally Flooded Shrubland Alliance**

**6110 = Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance**

High elevation willow coming off seeps and rivulets dominates the center portion of this photo.

Examples noted in the uppermost portions of Zone 4 through most of Zone 5 in rocky areas, especially common adjacent and in conjunction with spring-fed meadows and seeps on moderately steep slopes. Also observed along edges of alpine meadows

Taxa – Sparse to dense stands of Sierra Willow at least 2-5% absolute cover often in association with wetland meadow herbaceous vegetation such as reedgrass and seasonally flooded sedges
Microclimate –
Elevation – Generally above 9500 feet, locally down to 9000 feet in association with other alpine vegetation which may occur on adjacent slopes
Aspect – Variable
Shape – Concave to neutral
Slope Position – Variable
Steepness – Moderate to steep, rarely level
Hydrology – Temporarily to seasonally flooded
Fire – Infrequent to rare
Frequency – Very common in Zone 5 however polygons are moderate to small, often complexing with meadow and or mesic rock.

Note, the following similar map units can be confused with this type:

- Mesic Rock Mapping Unit (0500) - often occurs in close association with Sierra willow, but contains less than 2-5% willow cover, often in settings which contain extensive unbroken rock. Sierra willow is usually associated with small drainages on the slope and follows a more linear pattern than mesic rock.
- Whitebark Pine/Davidson Penstemon Association (3142) - stands where trees contain no emergent stems may be confused with willow. Krummholz trees are generally darker red signature, not as bright and occupy drier settings than the willow.
- Spring-fed meadows and seeps (8000's, 9000,s) on slopes often yield an IR signature as bright as willow, but with little or no texture noted on the photography.

Key Photo Signature Notes: Texture is the key in mapping this type out from associated meadows with similar IR signatures although willows can be quite small making it difficult to delineate out from the adjacent meadow.

## 6500 - 6990 - Superalliances and Alliance-level Mapping Units

## 6500 - Willow Mapping Units

Mapped based on zones and major environmental criteria. Willows are mapped in riparian, meadow and talus rocky settings.

Zonal willow categories have been aggregated up to 6500, 6600 or 6700 in the Final PI code

### 6500 - Willow spp./Meadow Shrubland Mapping Unit (Zones 2, 3, 4, 7, & 8)

Note: Aggregation type including original PI Codes 6503, 6505, 6507, 6510 & 6514
Generic class containing all zones where willows occur adjacent to or within meadows.

### 6600 - Willow spp. Riparian Shrubland Mapping Unit (Zones 2, 3, 4, 7, & 8)

Note: Aggregation type including original PI Codes 6502, 6504, 6508, 6511, 6513 & 6515
Generic class containing all zones where willows occur adjacent to rivulets, streams and rivers.

**Willow spp./Meadow Shrubland Mapping Unit**

This stand depicts zone 2 willow in a meadow environment in the southern end of Wawona Meadows.

### 6700 - Willow spp. Talus Shrubland Mapping Unit (Zones 2, 3, 4, & 7)

Note: Aggregation type including original PI Codes 6506 & 6512
Generic class containing all zones where willows occur in talus and scree settings.

Original PI Codes for Willow Mapping Units

6502 - Zone 8 Shrub Willow – Riparian Setting Mapping Unit
6503 - Zone 8 Shrub Willow – Meadow Setting Mapping Unit
6504 - Zone 7 Shrub Willow – Riparian Setting Mapping Unit
6505 - Zone 7 Shrub Willow – Meadow Setting Mapping Unit
6506 - Zone 7 Shrub Willow – Steep Talus Setting Mapping Unit
6507 - Zone 3 Shrub Willow Meadow Setting Mapping Unit
6508 - Zone 3 Shrub Willow Riparian Setting Mapping Unit
6510 - Zone 4 Shrub Willow Meadow Setting Mapping Unit
6511 - Zone 4 Shrub Willow Riparian Setting Mapping Unit
6512 - Zone 4 Shrub Willow Steep Talus Setting Mapping Unit
6513 - Zone 2 Shrub Willow Riparian Setting Mapping Unit
6514 - Zone 2 Shrub Willow Meadow Setting Mapping Unit
6515 - Zone 1 Shrub Willow Riparian Setting Mapping Unit
6516 - Zone 3 Shrub Willow Talus Setting Mapping Unit

## 6900 - Mesic Montane Shrubland Mapping Unit (Zones 3 & 4)

Note: Aggregation type includes original PI Codes 5220 & 7703

A mid to high elevation mesic shrub type found in a variety of settings; often as post fire shrub communities with a sparse conifer overstory.

Taxa – Bitter cherry often dominates but other species may locally dominate the shrub layer such as currant or gooseberry. This mapping unit is used also for very recent burns where the photointerpreter cannot tell what species are regenerating in the shrub layer.
Microclimate –Submesic to mesic
Elevation – Zones 2-4
Aspect – Variable
Shape – Variable
Slope Position – Mid to upper
Steepness – Variable
Hydrology – Upland
Frequency – Mapped

Note, the following similar map units can be confused with this type:

- Chaparral whitethorn regeneration – recent post fire
- Willow shrubland (*Salix* spp.) in more mesic settings

Key Photo Signature Notes: A highly variable signature depending primarily on the species composition of the stand. Difficult to determine abundance since so many species may be an important component in the stand varying greatly over small distances. Wet areas and small draws may contain more bitter cherry.

# 7000 – Herbaceous

**General Note Pertaining to Photointerpretation of Herbaceous Vegetation:** A methodology for possibly mapping meadows and other herbaceous types at more detailed levels using signature codes was discussed and agreed upon at the first field reconnaissance. Similar signature codes would hopefully yield types at the alliance, superalliance, or even at times association levels based on field crews visiting enough similar types to make that correlation.

For example: Signature type A – Meadow edge. Possibly temporarily flooded or saturated yielding a white signature (mature senesced tall grasslands?) occurring in Zones 1 and 2 may be either deergrass or *Agrostis gigantea* stands.

The intent was to enable the photointerpreter to delineate at a detailed level within meadow environments without having to commit to any identification. It was also for guiding the field crews to narrowing their search for types that need sampling.

## 7120 - Shorthair Sedge Herbaceous Alliance (Zones 4-6)

***Carex exserta* Herbaceous Alliance**

Extensive stands noted on the drier margins of high elevation meadows, including the Gaylor Lakes region and Parker Meadows.

Taxa – Moderately sparse to dense stands of shorthair sedge often in rocky or gravelly settings or adjacent to meadows
Microclimate – Submesic
Elevation – Above 9500 feet, Upper Zone 4, 5, and 6
Soil – Thin, often associated with gravel and rock
Aspect – Variable
Shape – Variable
Slope Position – Variable
Steepness – Nearly level to moderate
Geology – Minimal soil development from post-glacial formations
Hydrology – Temporarily saturated to upland
Fire – Fire is rare in this type
Frequency – Extensive stands in the alpine area

**7120 – Shorthair Sedge Alliance**

Shown here west of Gaylor Ridge, the light to cream color signatures represent varying densities of shorthair sedge. Wetter meadow species dominate the lower portion of the image.

Note, the following similar map units can be confused with this type:

- Dry alpine meadow signatures containing species such as Sierra ricegrass may be easily confused.
- Mesic Rock may contain small MMU's of shorthair sedge complexing with other meadow and willow patches.

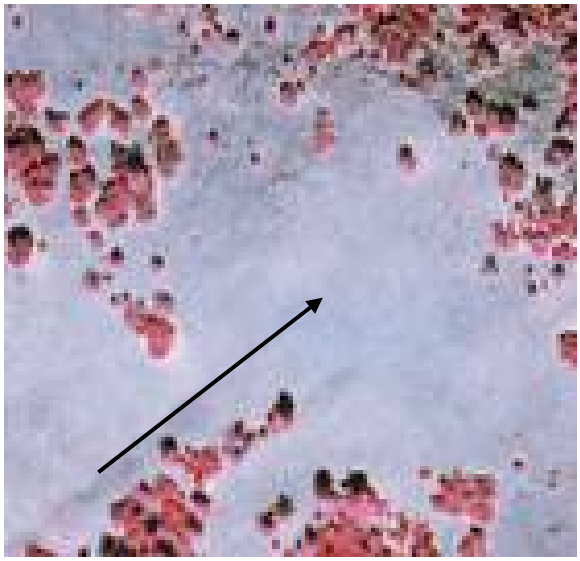
Key Photo Signature Notes: Map in conjunction with wetter meadows. Signature is variable depending on the current health of the sedge meadow. Drier stands generally have already died back on the August photography and yield a very light signature that could be mistaken for sparse herbaceous or rock.

### 7260 - California Annual Grassland/Herbland Superalliance (Zones 1 & 2)

Includes:
California Annual Grassland
California Annual Herbland

Observed over small areas in the lower portions of Zone 1 where tree cover was overall under (1-5%).

Taxa – Mainly non-native annual grass species (bromes, annual fescues, oats, barley) mixed with a small component of forbs (filaree, clovers) and native bunch grasses.
Microclimate – Xeric
Elevation – Lower portions of Zone 1
Soil – Well developed
Aspect – Generally south facing (in Yosemite environs)
Shape – Convex
Slope Position – Lower and mid slopes in environs
Steepness - Moderately to extremely steep
Geology – n/a
Hydrology – Upland
Fire – Establishes within 1 year of fire if not invaded by yellow star thistle
Frequency – Fairly common in the lowest portions of the environs however stands are overall limited in size.



**7260 = California Annual Grassland/Herbland Superalliance**

In August, this late season example is nearly devoid of IR signature. Oaks and gray pines are depicted toward the edges of this scene.

Note, the following similar map units can be confused with this type:

- California Annual Herbland probably for the most part falls below the MMU.
- Sparsely vegetated cliffs also have an extremely light signature; however texture variability is higher.

Key Photo Signature Notes: Nearly always in close proximity to stands of blue oak or interior live oak

## 7500 – 7990 - Upland Herbaceous and Upland Meadow Mapping Units

**Upland Herbaceous**
An east-side example near US 395, a small temporarily flooded portion is running through the center of this scene.

7500 - 7541 – Upland Herbaceous Mapping Units

### 7550 - Upland Graminoids (Zones 2, 3, & 8)

Note: Aggregation type including original PI Codes 7500, 7501, 7510, 7511, 7512, 7530, 7540, & 7541

Original PI Codes for Upland Herbaceous Mapping Units:

7500 - Zone 3 Upland continuous-forming graminoids
Note: Aggregated to type 7550 in PIFinal field
Has light photo signature.

7501 - Zone 1 Upland bunch-forming graminoids
Note: Aggregated to type 7550 in PIFinal field
Has light photo signature.

7510 - Zone 2 Upland continuous-forming graminoids
Note: Aggregated to type 7550 in PIFinal field
Has light photo signature.

7511 - Zone 2 Upland continuous-forming graminoids
Note: Aggregated to type 7550 in PIFinal field
Mid elevation meadow with tall “forbs” present and has gray photo signature.

7512 - Zone 2 Upland clonal circular-forming meadow
Note: Aggregated to type 7550 in PIFinal field
Mid elevation meadow with orange-brown mottled photo signature.

7530 - Zone 8 Upland Continuous Lower East Side
Note: Aggregated to type 7550 in PIFinal field
Lower East Side light medium gray photo signature.

7540 - Zone 4 Upland herbaceous on volcanics
Note: Aggregated to type 7550 in PIFinal field

7541 - Zone 4 Upland herbaceous on non-volcanics
Note: Aggregated to type 7550 in PIFinal field

### 7701 - Post-clearcut Shrub/Herbaceous Mapping Unit (Zones 1 & 2)

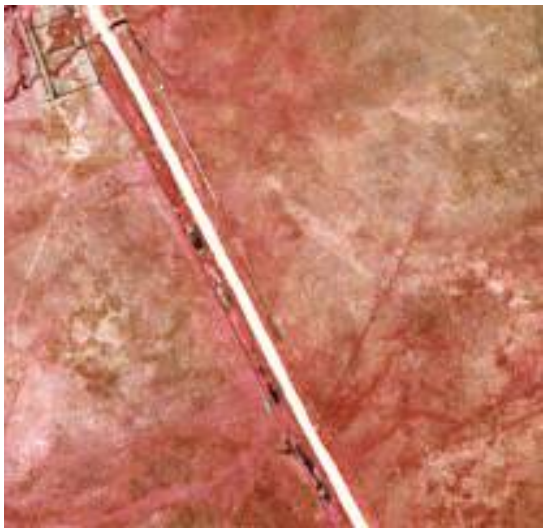
### 7702 - Mesic Post Fire Herbaceous Mapping Unit

7703 - Herbaceous vegetation and small crown-sprouting shrubs on xeric slopes
Note: Aggregated to type 6900 in PIFinal field

## 8000 - Intermittently to Seasonally Flooded Meadow

8500 - 8990 - Intermittently to Seasonally Flooded Meadow Mapping Units

Note: This entire series of PI codes was aggregated to PI code 8000 in the PIFinal field. The following codes occur in the PIPrefinal and PIOriginal fields only and are presented here for reference.



**8000 – Intermittently to Seasonally Flooded Meadow**
Several herbaceous alliances are visible in this eastside meadow.

8501 - Intermittently to Seasonally Flooded (Zone 1)
Continuous-forming graminoids, low elevation meadow with pink-red mottled photo signature.

8502 - Intermittently to Seasonally Flooded Meadow (Zone 1)
Continuous-forming graminoids, low elevation meadow with dark red-bright red even photo signature.

8510 - Intermittently to Seasonally Flooded Meadow (Zone 2)
Continuous-forming graminoids, mid elevation meadow with pink-red mottled photo signature.

8511 - Intermittently to Seasonally Flooded Meadow (Zone 2)
Continuous-forming graminoids, mid elevation meadow with orange-red-orange mottled photo signature.

8512 - Intermittently to Seasonally Flooded Meadow (Zone 2)
Graminoids (some clumping seen), mid elevation meadow with dark red mottled photo signature.

8513 - Intermittently to Seasonally Flooded Meadow (Zone 2)
Continuous-forming graminoids, mid elevation meadow, only saturated on slope with pink-red mottled photo signature.

8514 - Intermittently to Seasonally Flooded River Sandbar Forb (Zones 1 & 2)
Pink-red mottled photo signature

8515 - Intermittently to Seasonally Flooded Meadow (Zone 2)
Continuous forming graminoids, mid elevation meadow with light brown-orange-light gray photo signature.

8530 - Intermittently to Seasonally Flooded Meadow (Zone 8)
Continuous lower east side with pink-red photo signature

8531 - Intermittently to Seasonally Flooded Meadow (Zone 8)
Continuous lower east side with orange-brown mottled photo signature

8532 - Intermittently to Seasonally Flooded Meadow (Zone 8)
Continuous lower east side with light tan to light pink photo signature

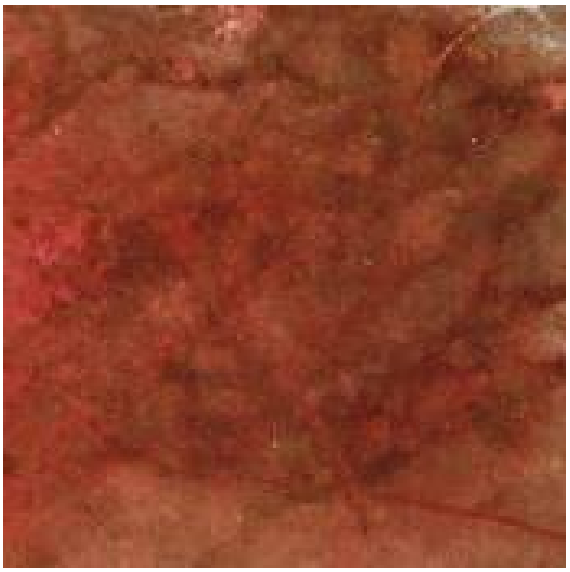
8533 - Intermittently to Seasonally Flooded Meadow (Zone 8)
Continuous lower east side with gray-brown photo signature

8540 - Intermittently to Seasonally Flooded Meadow (Zone 7)
Continuous upper east side with pink-red photo signature
8541 - Intermittently to Seasonally Flooded Meadow (Zone 7)
Continuous upper east side with orange-brown mottled photo signature.
8542 - Intermittently to Seasonally Flooded Meadow (Zone 7)
Continuous upper east side with light tan to light pink photo signature
8543 - Intermittently to Seasonally Flooded Meadow (Zone 7)
Continuous upper east side with gray-brown photo signature
8544 - Intermittently to Seasonally Flooded Meadow (Zone 7)
Continuous-forming graminoids upper east side with orange photo signature
8550 - Intermittently to Seasonally Flooded Meadow (NWI j or a) (Zone 3)
Continuous with light pink to magenta signature, even, slightly mottled
8551 - Intermittently to Seasonally Flooded Meadow (NWI c or d) (Zone 3)
Continuous with orange-brown signature, usually highly mottled
8552 - Intermittently to Seasonally Flooded Meadow (NWI j or a) (Zone 3)
Continuous with very light tan to light gray signature, slight mottling
8555 - Intermittently to Seasonally Flooded Meadow (NWI e) (Zone 3)
Continuous with light pink to magenta signature, even, slightly mottled
8557 - Intermittently to Seasonally Flooded Meadow (NWI e) (Zone 3)
Continuous with very light tan to light gray signature, slight mottling
8558 - Intermittently to Seasonally Flooded Meadow (NWI b) (Zone 3)
Continuous with orange-brown signature, usually highly mottled
8560 - Intermittently to Seasonally Flooded Meadow (NWI j or a) (Zone 4)
Continuous with light pink to magenta signature, even, slightly mottled
8561 - Intermittently to Seasonally Flooded Meadow (NWI c or d) (Zone 4)
Continuous with orange-brown, usually highly mottled signature
8562 - Intermittently to Seasonally Flooded Meadow (NWI j or a) (Zone 4)
Continuous with very light tan to light gray, slight mottling signature
8565 - Intermittently to Seasonally Flooded Meadow (NWI e) (Zone 4)
Continuous with light pink to magenta, even, slightly mottled signature
8567 - Intermittently to Seasonally Flooded Meadow (NWI e) (Zone 4)
Continuous with very light tan to light gray, slight mottling signature
8568 - Intermittently to Seasonally Flooded Meadow (NWI b) (Zone 4)
Continuous with orange-brown, usually highly mottled signature
8571 - Intermittently to Seasonally Flooded Meadow (NWI c or d) (Zones 5 & 6)
Continuous with orange to brown, usually highly mottled signature
8572 - Intermittently to Seasonally Flooded Meadow (NWI b) (Zones 5 & 6)
Continuous with orange to brown, usually highly mottled signature

# 9000 - Semi-permanently to Permanently Flooded Meadow

### 9030 - Bullrush-Cattail Mapping Unit (Zone 1& 2)

Note: Aggregated to 9000 in the PIFinal field.



**9000 Semi-permanently to Permanently Flooded**
This example represents a seasonally flooded meadow on the east side.

9500 - 9990 - Semi-permanently to Permanently Flooded Meadow Mapping Units

Note: This entire series of PI codes was aggregated to PI code 9000 in the PIFinal field. The following codes in this series occur in the PIPrefinal and PIOriginal fields only and are presented here for reference.

9501 - Semi-permanently to Permanently Flooded Meadow (Zone 2)
Continuous-forming graminoid, mid elevation meadow with pink even signature

9502 - Semi-permanently to Permanently Flooded Meadow (Zone 2)
Mid elevation meadow with orange to red-orange mottled signature

9503 - Semi-permanently to Permanently Flooded Meadow (Zone 2)
Mid elevation meadow, only saturated if on slope with very dark red-brown mottled signature

9510 - Semi-permanently to Permanently Flooded Meadow (Zone 2)
Continuous-forming grassland, mid elevation meadow, only saturated if on slope with orange to orange-red mottled signature

9530 - Semi-permanently to Permanently Flooded Meadow (Zone 8)
Continuous lower east side with pink-red signature

9531 - Semi-permanently to Permanently Flooded Meadow (Zone 8)
Continuous lower east side with dark brown mottled signature

9540 - Semi-permanently to Permanently Flooded Meadow (Zone 7)
Continuous upper east side with pink-red signature

9541 - Semi-permanently to Permanently Flooded Meadow (Zone 7)
Continuous upper east side with dark brown mottled signature

9542 - Semi-permanently to Permanently Flooded Meadow (Zone 7)
Continuous-forming graminoids, upper east side with orange signature

9550 - Semi-permanently to Permanently Flooded Meadow (NWI f, g or h) (Zone 3)
Signature is dark orange to dark brown, usually highly mottled

9551 - Semi-permanently to Permanently Flooded Meadow, (NWI b) (Zone 3)
Signature is dark orange to dark brown, usually highly mottled

9552 - Semi-permanently to Permanently Flooded Meadow (NWI f, g, or H) (Zone 3)
Medium gray-brown even signature

9560 - Semi-permanently to Permanently Flooded Meadow (NWI f, g or h) (Zone 4)
Signature is dark orange to dark brown, usually highly mottled

9561 - Semi-permanently to Permanently Flooded Meadow (NWI b) (Zone 4)
Signature is dark orange to dark brown, usually highly mottled

9570 - Semi-permanently to Permanently Flooded Meadow (Zones 5 & 6)
Signature is dark orange to dark brown, usually highly mottled

9571 - Semi-permanently to Permanently Flooded Meadow (Zones 5 & 6)
Signature is dark orange to dark brown, usually highly mottled

# Appendix P: Mapping Classification to Vegetation Classification Crosswalk

Crosswalk table between the mapping and floristic classifications for Yosemite National Park and surrounding areas for the vegetation map based upon 1997 aerial photography. Multiple entries in the vegetation (or floristic) classification next to a mapping class indicates more than one floristic class is represented by the mapping class. The occurrence of a vegetation class within more than one mapping class indicates that the vegetation class is represented by or may occur within more than one mapping class. Left arrow (<): Vegetation class is a subset of the mapping class (vegetation class is at a lower level in the classification hierarchy). Equals sign (=): Vegetation class and mapping class are equivalent. Right arrow (>): Mapping class is a subset of the vegetation class (mapping class is at a lower level in the classification hierarchy). Entries of “None” for the vegetation (or floristic) classification indicate that the mapping class is not represented in the vegetation classification (e.g., no floristic class for “conifer reproduction”). Entries of “None” for a mapping class when there is at least one entry for that class in the vegetation classification column indicate that there is more variation in the mapping class than is represented by the vegetation class alone (e.g., see 2520 where there is no bigleaf maple class in the vegetation classification). Similarly, when an alliance name occurs in the vegetation classification column in addition to a sub-alliance entry (e.g., 4035).

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 100 | Alpine Talus Slope | Alpine Talus Slope | | None | None |
| 200 | Alpine Scree Slope | Alpine Scree Slope | | None | None |
| 300 | Alpine Snow Patch Communities | Alpine Snow Patch Communities | | None | None |
| 500 | Mesic Rock Outcrop | Mesic Rock Outcrop | | None | None |
| 700 | Boulder Field | Boulder Field | | None | None |
| 910 | Conifer Reproduction | Conifer Reproduction | | None | None |
| 920 | Conifer Plantation | Conifer Plantation | | None | None |
| 940 | Sparsely Vegetated Undifferentiated | Sparsely Vegetated Undifferentiated | | None | None |
| 941 | Sparsely Vegetated Riverine Flat | Sparsely Vegetated Riverine Flat | | None | None |
| 950 | Non-alpine Talus | Non-alpine Talus | | None | None |
| 961 | Sparsely Vegetated to Non-vegetated Exposed Rock | Sparsely Vegetated to Non-vegetated Exposed Rock | | None | None |
| 963 | Dome | Dome | | None | None |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 964 | Fissured Rock Outcrop | Fissured Rock Outcrop | | None | None |
| 965 | Sparsely Vegetated Rocky Streambed | Sparsely Vegetated Rocky Streambed | | None | None |
| 970 | Alpine Permanent Snowfield/Glacier | Alpine Permanent Snowfield/Glacier | | None | None |
| 980 | Water | Water | | None | None |
| 981 | Permanently Flooded, Emergent, or Floating Vegetation Mapping Unit | Permanently Flooded, Emergent, or Floating Vegetation Mapping Unit | | None | None |
| 990 | Urban/Developed | Urban/Developed | | None | None |
| 1020 | Canyon Live Oak Forest Alliance | *Quercus chrysolepis* Forest Alliance | = | Canyon Live Oak Forest Alliance | *Quercus chrysolepis* Forest Alliance |
| 1022 | Canyon Live Oak/Whiteleaf Manzanita Forest Association | *Quercus chrysolepis*/*Arctostaphylos viscida* Forest Association | = | Canyon Live Oak/Whiteleaf Manzanita Forest | *Quercus chrysolepis*/*Arctostaphylos viscida* Forest |
| 1023 | Canyon Live Oak-(Ponderosa Pine-Incense-cedar) Forest Superassociation | *Quercus chrysolepis*-(*Pinus ponderosa-Calocedrus decurrens)* Forest Superassociation | < | Canyon Live Oak-Ponderosa Pine Forest | *Quercus chrysolepis-Pinus ponderosa* Forest |
| | | | < | Canyon Live Oak-Incense-cedar Forest | *Quercus chrysolepis-Calocedrus decurrens* Forest |
| 1024 | Canyon Live Oak-California Laurel Forest Association | *Quercus chrysolepis-Umbellularia californica* Forest Association | = | Canyon Live Oak-California Laurel Forest | *Quercus chrysolepis-Umbellularia californica* Forest |
| 1026 | Canyon Live Oak-Gray Pine Forest Association | *Quercus chrysolepis-Pinus sabiniana* Forest Association | = | Canyon Live Oak-Gray Pine Forest | *Quercus chrysolepis-Pinus sabiniana* Forest |
| 1029 | Canyon Live Oak/Greenleaf Manzanita Forest Association | *Quercus chrysolepis/Arctostaphylos patula* Forest Association | = | Canyon Live Oak/Greenleaf Manzanita Forest | *Quercus chrysolepis*/*Arctostaphylos patula* Forest |
| 1043 | Interior Live Oak-Canyon Live Oak Woodland Association | *Quercus wislizeni-Quercus chrysolepis* Woodland Association | = | Interior Live Oak-Canyon Live Oak Woodland | *Quercus wislizeni-Quercus chrysolepis* Woodland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 1510 | Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit | *Quercus chrysolepis*/*Aesculus californica* & *Quercus wislizeni-Aesculus californica* Shrubland Mapping Unit | < | Interior Live Oak-California Buckeye Shrubland | *Quercus wislizeni-Aesculus californica* Shrubland |
| 1520 | Blue Oak–(Interior Live Oak–Gray Pine/Buckbrush/Annual Grass) Woodland Mapping Unit | *Quercus douglasii*-(*Quercus wislizeni-Pinus sabiniana*/*Ceanothus cuneatus*/Annual Grass) Woodland Mapping Unit | < | Interior Live Oak-Blue Oak-Gray Pine/Brome spp.-American Wild Carrot Woodland | *Quercus wislizeni-Q. douglasii-Pinus sabiniana*/*Bromus* spp.-*Daucus pusillus* Woodland |
| | | | < | Blue Oak–Gray Pine/Grass Woodland | *Quercus douglasii-Pinus sabiniana*/Grass spp. Woodland |
| | | | < | Blue Oak/Brome spp.-American Wild Carrot Woodland | *Quercus douglasii*/*Bromus* spp.-*Daucus pusillus* Woodland |
| | | | < | Blue Oak-Interior Live Oak/Brome spp.-American Wild Carrot Woodland | *Quercus douglasii-Q. wislizeni*/*Bromus* spp.-*Daucus pusillus* Woodland |
| | | | < | Blue Oak/Buckbrush/Annual Grass Woodland | *Quercus douglasii*/*Ceanothus cuneatus*/Annual Grass Woodland |
| 1530 | Interior Live Oak Woodland & Shrubland Superalliance | *Quercus wislizeni* Woodland & Shrubland Superalliance | = | Interior Live Oak Woodland Alliance | *Quercus wislizeni* Woodland Alliance |
| | | | < | Interior Live Oak Shrubland Alliance | *Quercus wislizeni* Shrubland Alliance |
| | | | < | Interior Live Oak/Poison Oak Shrubland | *Quercus wislizeni*/*Toxicodendron diversilobum* Shrubland |
| 2010 | Quaking Aspen Forest Alliance | *Populus tremuloides Forest Alliance* | = | Quaking Aspen Forest Alliance | *Populus tremuloides* Forest Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | Quaking Aspen/Mountain Monardella Forest | *Populus tremuloides*/*Monardella odoratissima* Forest |
| | | | < | Quaking Aspen/Kentucky Bluegrass Forest | *Populus tremuloides*/*Poa pratensis* Forest |
| 2011 | Quaking Aspen/California False Hellebore Forest Association | *Populus tremuloides*/*Veratrum californicum* Forest Association | = | Quaking Aspen/California False Hellebore Forest | *Populus tremuloides*/*Veratrum californicum*Forest |
| 2013 | Quaking Aspen/Willow spp. Forest Mapping Unit | *Populus tremuloides*/*Salix* spp. Forest Mapping Unit | < | Quaking Aspen/Woods' Rose Forest | *Populus tremuloides*/*Rosa woodsii* Forest |
| 2014 | Quaking Aspen/Willow spp. Talus Mapping Unit | *Populus tremuloides*/*Salix* spp. Talus Mapping Unit | | None | None |
| 2015 | Quaking Aspen-Jeffrey Pine/(Big Sagebrush) Forest Association | *Populus tremuloides-Pinus jeffreyi*/(*Artemisia tridentata*) Forest Association | = | Quaking Aspen-Jeffrey Pine Forest | *Populus tremuloides-Pinus jeffreyi* Forest |
| 2016 | Quaking Aspen/Big Sagebrush Forest Superassociation | *Populus tremuloides*/*Artemisia tridentata* Forest Superassociation | < | Quaking Aspen/Big Sagebrush Forest | Populus tremuloides/Artemisia tridentata Forest |
| | | | < | Quaking Aspen/Big Sagebrush/Mountain Monardella-Milky Kelloggia Forest | *Populus tremuloides/Artemisia tridentata/Kelloggia galioides* Forest |
| 2020 | California Black Oak Forest Alliance | *Quercus kelloggii* Forest Alliance | = | California Black Oak Forest Alliance | *Quercus kelloggii* Forest Alliance |
| | | | < | California Black Oak/Indian Manzanita-Mountain Misery Forest | *Quercus kelloggii/Arctostaphylos mewukka-Chamaebatia foliolosa* Forest |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 2021 | California Black Oak/Greenleaf Manzanita Forest Association | *Quercus kelloggii/Arctostaphylos patula* Forest Association | = | California Black Oak/Greenleaf Manzanita Forest | *Quercus kelloggii/Arctostaphylos patula* Forest |
| 2022 | California Black Oak-Incense-cedar Forest Association | *Quercus kelloggii-Calocedrus decurrens* Forest Association | = | California Black Oak-Incense-cedar Forest | *Quercus kelloggii-Calocedrus decurrens* Forest |
| 2025 | California Black Oak/(Bracken Fern) Forest Mapping Unit | *Quercus kelloggii*/(*Pteridium aquilinum*) Forest Mapping Unit | | None | None |
| 2040 | Valley Oak Woodland Alliance | *Quercus lobata* Woodland Alliance | = | Valley Oak Woodland Alliance | *Quercus lobata* Woodland Alliance |
| 2050 | Black Cottonwood Temporarily Flooded Forest Alliance | *Populus balsamifera* ssp. *trichocarpa* Temporarily Flooded Forest Alliance | = | Black Cottonwood Temporarily Flooded Forest Alliance | *Populus balsamifera ssp. trichocarpa Temporarily Flooded Forest Alliance* |
| 2052 | Black Cottonwood-Quaking Aspen-(Jeffrey Pine)/Willow spp. Mapping Unit | *Populus balsamifera ssp. trichocarpa-Populus tremuloides-(Pinus jeffreyi)/Salix* spp. Mapping Unit | < | Black Cottonwood-Jeffrey Pine Forest | *Populus balsamifera* ssp. *trichocarpa-Pinus jeffreyi* Forest |
| 2070 | Mountain Alder Mapping Unit | *Alnus incana* ssp. *tenuifolia* Mapping Unit | | None | None |
| 2510 | Willow spp. Forest Mapping Unit | *Salix* spp. Forest Mapping Unit | | None | None |
| 2520 | White Alder & Bigleaf Maple Forest Superalliance | *Alnus rhombifolia* & *Acer macrophyllum* Forest Superalliance | < | White Alder Temporarily Flooded Forest Alliance | *Alnus rhombifolia* Temporarily Flooded Forest Alliance |
| | | | | None | None |
| 3010 | Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Forest Mapping Unit | *Pinus contorta* var. *murrayana-Populus tremuloides-*(*Pinus jeffreyi*) | | None | None |
| | | | > | Quaking Aspen Forest Alliance | *Populus tremuloides* Forest Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | Forest Mapping Unit | < | Quaking Aspen-Jeffrey Pine Forest | *Populus tremuloides-Pinus jeffreyi* Forest |
| 3012 | Sierra Lodgepole Pine-Quaking Aspen/(Kentucky Bluegrass) Forest Mapping Unit | *Pinus contorta* var. *murrayana-Populus tremuloides*/(*Poa pratensis*) Forest Mapping Unit | | None | None |
| | | | < | Quaking Aspen-Sierra Lodgepole Pine/Big Sagebrush/Kentucky Bluegrass Forest | *Populus tremuloides-Pinus contorta* var. *murrayana*/*Artemisia tridentata*/*Poa pratensis* Forest |
| | | | > | Quaking Aspen Forest Alliance | *Populus tremuloides* Forest Alliance |
| 3020 | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta* var. *murrayana* Forest Alliance | = | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta* var. *murrayana* Forest Alliance |
| 3022 | Sierra Lodgepole Pine/(Bog Blueberry) Forest Mapping Unit | *Pinus contorta* var. *murrayana*/(*Vaccinium uliginosum*) Forest Mapping Unit | < | Sierra Lodgepole Pine/Bog Blueberry Forest | *Pinus contorta* var. *murrayana*/*Vaccinium uliginosum* Forest |
| 3026 | Sierra Lodgepole Pine Woodlands Superassociation | *Pinus contorta* var. *murrayana* Woodlands Superassociation | < | Sierra Lodgepole Pine/Mountain Pride Woodland | *Pinus contorta* var. *murrayana*/*Penstemon newberryi* Woodland |
| | | | < | Sierra Lodgepole Pine Woodland | *Pinus contorta* var. *murrayana* Woodland |
| | | | < | Sierra Lodgepole Pine/Shorthair Sedge Woodland | *Pinus contorta* var. *murrayana*/*Carex exserta* Woodland |
| 3027 | Sierra Lodgepole Pine/(Big Sagebrush–Roundleaf Snowberry-Currant-Red Mountainheather) Forest Mapping Unit | *Pinus contorta* var. *murrayana*/(*Artemisia tridentata-Symphoricarpos rotundifolius-Ribes* sp.-*Phyllodoce breweri*) Forest Mapping Unit | < | Sierra Lodgepole Pine/Big Sagebrush Forest | *Pinus contorta* var. *murrayana*/*Artemisia tridentata* Forest |

| Map Code (PlFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 3028 | Sierra Lodgepole Pine-(Whitebark Pine)/(Ross Sedge-Shorthair Sedge) Forest Superassociation | *Pinus contorta* var. *murrayana* - (*Pinus albicaulis*)/(*Carex rossii*-*Carex exserta*) Forest Superassociation | < | Sierra Lodgepole Pine/Ross Sedge Forest | *Pinus contorta* var. *murrayana*/*Carex rossii* Forest |
| | | | < | Sierra Lodgepole Pine-Whitebark Pine/Ross Sedge Forest | *Pinus contorta* var. *murrayana*-*Pinus albicaulis*/*Carex rossii* Forest |
| | | | < | Sierra Lodgepole Pine-Whitebark Pine/Shorthair Sedge Forest | *Pinus contorta* var. *murrayana*-*Pinus albicaulis*/*Carex exserta* Forest |
| 3047 | Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Forest Mapping Unit | *Pinus contorta* var. *murrayana*/(*Artemisia tridentata*)/(*Poa pratensis*) Forest Mapping Unit | > | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta var. murrayana Forest Alliance* |
| 3048 | Sierra Lodgepole Pine Mesic Forest Superassociation | *Pinus contorta* var. *murrayana* Mesic Forest Superassociation | < | Sierra Lodgepole Pine /Western Labrador Tea Forest | *Pinus contorta* var. *murrayana*/*Ledum glandulosum* Forest |
| | | | < | Sierra Lodgepole Pine/Gray's Licorice-root Forest | *Pinus contorta* var. *murrayana*/*Ligusticum grayi* Forest |
| 3049 | Sierra Lodgepole Pine Xeric Forest Superassociation | *Pinus contorta* var. *murrayana* Xeric Forest Superassociation | > | Sierra Lodgepole Pine Forest Alliance | *Pinus contorta var. murrayana Forest Alliance* |
| | | | < | Sierra Lodgepole Pine/Ross Sedge Forest | *Pinus contorta* var. *murrayana*/*Carex rossii* Forest |
| 3050 | Ponderosa Pine Woodland Alliance | *Pinus ponderosa* Woodland Alliance | = | Ponderosa Pine Woodland Alliance | *Pinus ponderosa* Woodland Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 3053 | Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association | *Pinus ponderosa-Quercus kelloggii/Arctostaphylos viscida Woodland Association* | = | Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland | *Pinus ponderosa-Quercus kelloggii/Arctostaphylos viscida* Woodland |
| 3060 | Ponderosa pine-Incense-cedar Forest Alliance | *Pinus ponderosa-Calocedrus decurrens* Forest Alliance | = | Ponderosa Pine-Incense-cedar Forest Alliance | *Pinus ponderosa-Calocedrus decurrens* Woodland Alliance |
| 3066 | Ponderosa pine–Incense-cedar–(California Black Oak–Canyon Live Oak) Forest Superassociation | *Pinus ponderosa-Calocedrus decurrens-(Quercus kelloggii-Quercus chrysolepis) Forest Superassociation* | < | Ponderosa Pine-Incense-cedar-Canyon Live Oak/Mountain Misery Forest | *Pinus ponderosa-Calocedrus decurrens-Quercus chrysolepis/Chamaebatia foliolosa* Forest |
| | | | < | Ponderosa Pine-Incense-cedar/Mountain Misery Forest | *Pinus ponderosa-Calocedrus decurrens/Chamaebatia foliolosa* Forest |
| | | | < | Ponderosa Pine-Incense-cedar-California Black Oak Forest | *Pinus ponderosa-Calocedrus decurrens-Quercus kelloggii* Forest |
| 3070 | Jeffrey Pine Woodland Alliance | *Pinus jeffreyi* Woodland Alliance | = | Jeffrey Pine Woodland Alliance | *Pinus jeffreyi* Woodland Alliance |
| | | | < | Jeffrey Pine/Bush Chinquapin Woodland | *Pinus jeffreyi/Chrysolepis sempervirens* Woodland |
| 3072 | Jeffrey Pine/Greenleaf Manzanita Woodland Association | *Pinus jeffreyi/Arctostaphylos patula* Woodland Association | = | Jeffrey Pine/Greenleaf Manzanita Woodland | *Pinus jeffreyi/Arctostaphylos pautla* Woodland |
| 3073 | Jeffrey Pine/Whitethorn Ceanothus Woodland Association | *Pinus jeffreyi/Ceanothus cordulatus* Woodland Association | = | Jeffrey Pine/Whitethorn Ceanothus Woodland | *Pinus jeffreyi/Ceanothus cordulatus* Woodland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 3075 | Jeffrey Pine/Huckleberry Oak Woodland Association | *Pinus jeffreyi/Quercus vaccinifolia Woodland Association* | = | Jeffrey Pine/Huckleberry Oak Woodland | *Pinus jeffreyi/Quercus vaccinifolia* Woodland |
| 3076 | Jeffrey Pine/Antelope Bitterbrush Woodland Association | *Pinus jeffreyi/Purshia tridentata* Woodland Association | = | Jeffrey Pine/Antelope Bitterbrush Woodland | *Pinus jeffreyi/Purshia tridentata* Woodland |
| 3081 | Jeffrey Pine-Singleleaf Pinyon Pine Woodland Association | *Pinus jeffreyi-Pinus monophylla* Woodland Association | = | Jeffrey Pine-Singleleaf Pinyon Pine Woodland | *Pinus jeffreyi-Pinus monophylla* Woodland |
| 3082 | Jeffrey Pine/Curl-leaf Mountain Mahogany Woodland Association | *Pinus jeffreyi/Cercocarpus ledifolius* Woodland Association | = | Jeffrey Pine/Curl-leaf Mountain Mahogany Woodland | *Pinus jeffreyi/Cercocarpus ledifolius* Woodland |
| 3083 | Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland Association | *Pinus jeffreyi-Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland Association | = | Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland | *Pinus jeffreyi-Abies concolor/Symphoricarpos rotundifolius/Elymus elymoides* Woodland |
| 3084 | Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association | *Pinus jeffreyi-Quercus chrysolepis/Arctostaphylos viscida Woodland Association* | = | Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland | *Pinus jeffreyi-Quercus chrysolepis/Arctostaphylos viscida* Woodland |
| 3085 | Jeffrey Pine-California Red Fir Woodland Association | *Pinus jeffreyi-Abies magnifica* Woodland Association | = | California Red Fir-Jeffrey Pine Woodland | *Abies magnifica-Pinus jeffreyi* Woodland |
| 3090 | Gray Pine Woodland Alliance | *Pinus sabiniana* Woodland Alliance | = | Gray Pine Woodland Alliance | *Pinus sabiniana* Woodland Alliance |
| | | | < | Gray Pine/Buckbrush/Grass Woodland | *Pinus sabiniana/Ceanothus cuneatus*/Grass Woodland |
| 3097 | Gray Pine-Interior Live Oak/(Whiteleaf Manzanita-Buckbrush-Chamise) | *Pinus sabiniana-Quercus wislizenii*/(*Arctostaphylos viscida-Ceanothus* | < | Gray Pine-Interior Live Oak/Whiteleaf Manzanita Woodland | *Pinus sabiniana-Quercus wislizenii/Arctostaphylos viscida* Woodland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | Woodland Superassociation | *cuneatus-Adenostoma fasciculatum*) Woodland Superassociation | < | Gray Pine-Interior Live Oak/Buckbrush Woodland | *Pinus sabiniana-Quercus wislizeni*/*Ceanothus cuneatus* Woodland |
| | | | < | Gray Pine-Interior Live Oak/Chamise Woodland | *Pinus sabiniana-Quercus wislizeni*/*Adenostoma fasciculatum* Woodland |
| 3101 | Knobcone Pine/Whiteleaf Manzanita Woodland Association | *Pinus attenuata*/*Arctostaphylos viscida* Woodland Association | = | Knobcone Pine/Whiteleaf Manzanita Woodland | *Pinus attenuata*/*Arctostaphylos viscida* Woodland |
| 3102 | Knobcone Pine-Canyon Live Oak Woodland Mapping Unit | *Pinus attenuata-Quercus chrysolepis Woodland Mapping Unit* | | **None** | **None** |
| 3105 | Knobcone Pine/Chamise Woodland Association | *Pinus attenuata*/*Adenostoma fasciculata* Woodland Association | = | Knobcone Pine/Chamise Woodland | *Pinus attenuata*/*Adenostoma fasciculatum* Woodland |
| 3110 | Singleleaf Pinyon Pine Woodland Alliance | *Pinus monophylla* Woodland Alliance | = | Single-leaf Pinyon Pine Woodland Alliance | *Pinus monophylla* Woodland Alliance |
| 3112 | Singleleaf Pinyon Pine/Curl-leaf Mountain Mahogany-Big Sagebrush-Antelope Bitterbrush Woodland Association | *Pinus monophylla*/*Cercocarpus ledifolius-Artemisia tridentata-Purshia tridentata* Woodland Association | = | Single-leaf Pinyon Pine-Curl-leaf Mountain Mahogany/Big Sagebrush-Antelope Bitterbrush Woodland | *Pinus monophylla-Cercocarpus ledifolius*/*Artemisia tridentata-Purshia tridentata* Woodland |
| 3113 | Singleleaf Pinyon Pine/(Desert Gooseberry Big Sagebrush/Squirreltail) Woodland Superassociation | *Pinus monophylla*/(*Ribes velutinum-Artemisia tridentata*/*Elymus elymoides*) Woodland Superassociation | < | Singleleaf Pinyon Pine/Desert Gooseberry Woodland | *Pinus monophylla*/*Ribes velutinum* Woodland |
| | | | < | Singleleaf Pinyon Pine/Big Sagebrush/Squirreltail Woodland | *Pinus monophylla*/*Artemisia tridentata*/*Elymus elymoides* Woodland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 3131 | Western White Pine/Western Needlegrass Woodland Mapping Unit | *Pinus monticola*/*Achnatherum occidentale* Woodland Mapping Unit | < | Western White Pine-Sierra Lodgepole Pine/Western Needlegrass Woodland | *Pinus monticola-Pinus contorta* var. *murrayana*/*Achnatherum occidentale* Woodland |
| 4510 | Western White Pine–(California Red Fir–Sierra Lodgepole Pine) Forest Superalliance | *Pinus monticola*-(*Abies magnifica-Pinus contorta* var. *murrayana*) Forest Superalliance | < | Western White Pine–Sierra Lodgepole Pine/Western Needlegrass Woodland | *Pinus monticola-Pinus contorta* var. *murrayana*/*Achnatherum occidentale* Woodland |
| | | | < | California Red Fir–Western White Pine–Sierra Lodgepole Pine Forest | *Abies magnifica-Pinus monticola-Pinus contorta* var. *murrayana* Forest |
| | | | < | California Red Fir–Western White Pine Forest | *Abies magnifica-Pinus monticola* Forest |
| 3140 | Whitebark Pine Woodland Alliance | *Pinus albicaulis* Woodland Alliance | = | Whitebark Pine Woodland Alliance | *Pinus albicaulis* Woodland Alliance |
| 3143 | Whitebark Pine/(Ross Sedge-Shorthair Sedge) Woodland Superassociation | *Pinus albicaulis*/(*Carex rossii-Carex exserta*) Woodland Superassociation | < | Whitebark Pine/Shorthair Sedge Woodland | *Pinus albicaulis*/*Carex exserta* Woodland |
| | | | < | Whitebark Pine/Ross Sedge Woodland | *Pinus albicaulis*/*Carex rossii* Woodland |
| 3147 | Whitebark Pine–Mountain Hemlock Woodland Association | *Pinus albicaulis-Tsuga mertensiana* Woodland Association | = | Whitebark Pine–Mountain Hemlock Woodland | *Pinus albicaulis-Tsuga mertensiana* Woodland |
| 3149 | Whitebark Pine-(Sierra Lodgepole Pine-Mountain Hemlock) Krummholz Conifer Mapping Unit | *Pinus albicaulis*-(*Pinus contorta* var. *murrayana-Tsuga mertensiana*) Krummholz Conifer Mapping Unit | < | Whitebark Pine/Davidson's Penstemon Woodland | *Pinus albicaulis*/*Penstemon davidsonii* Woodland |
| 3150 | Limber Pine Woodland Alliance | *Pinus flexilis* Woodland Alliance | = | Limber Pine Woodland Alliance | *Pinus flexilis* Woodland Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 4012 | Douglas-fir-Canyon Live Oak Forest Association | *Pseudotsuga menziesii-Quercus chrysolepis* Forest Association | = | Douglas-fir-Canyon Live Oak Forest | *Pseudotsuga menziesii-Quercus chrysolepis* Forest |
| 4014 | Douglas-fir-White Alder Forest Association | *Pseudotsuga menziesii-Alnus rhombifolia* Forest Association | = | Douglas-fir-White Alder Forest | *Pseudotsuga menziesii-Alnus rhombifolia* Forest |
| 4550 | Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit | *Pseudotsuga menziesii-(Abies concolor-Calocedrus decurrens-Pinus ponderosa)* Forest Mapping Unit | < | Douglas-fir–White Fir–Incense-cedar Forest | *Pseudotsuga menziesii-Abies concolor-Calocedrus decurrens* Forest |
| | | | < | Douglas-fir–Ponderosa Pine-Incense-cedar Forest | *Pseudotsuga menziesii-Pinus ponderosa-Calocedrus decurrens* Forest |
| 4020 | Giant Sequoia Forest Alliance | *Sequoiadendron giganteum* Forest Alliance | = | Giant Sequoia Forest Alliance | *Sequoiadendron giganteum* Forest Alliance |
| 4021 | Giant Sequoia-Sugar Pine/Pacific Dogwood Forest Association | *Sequoiadendron giganteum-Pinus lambertiana/Cornus nuttallii* Forest Association | = | Giant Sequoia-Sugar Pine/Pacific Dogwood Forest | *Sequoiadendron giganteum-Pinus lambertiana/Cornus nuttallii* Forest |
| 4035 | Mountain Hemlock–(Western White Pine–Sierra Lodgepole Pine) Forest Superassociation | *Tsuga mertensiana-(Pinus monticola-Pinus contorta* var. *murrayana)* Forest Superassociation | > | Mountain Hemlock Forest Alliance | *Tsuga mertensiana* Forest Alliance |
| | | | < | Mountain Hemlock Forest | *Tsuga mertensiana* Forest |
| | | | < | Mountain Hemlock-Western White Pine Forest | *Tsuga mertensiana-Pinus monticola* Forest |
| | | | < | Mountain Hemlock-Sierra Lodgepole Pine Forest | *Tsuga mertensiana-Pinus contorta* var. *murrayana* Forest |
| | | | < | Mountain Hemlock–Sierra Lodgepole Pine–Western White Pine Forest | *Tsuga mertensiana-Pinus contorta* var. *murrayana-Pinus monticola* Forest |
| 4056 | California Red Fir–(Sierra Lodgepole Pine) Forest Superassociation | *Abies magnifica-(Pinus contorta* var. *murrayana)* Forest Superassociation | > | California Red Fir Forest Alliance | *Abies magnifica* Forest Alliance |
| | | | < | California Red Fir Forest | *Abies magnifica* Forest |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | California Red Fir–Sierra Lodgepole Pine/Whiteflower Hawkweed Forest | *Abies magnifica-Pinus contorta* var. *murrayana*/*Hieracium albiflorum* Forest |
| 4069 | California Red Fir–(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation | *Abies magnifica-(Pinus monticola)/(Chrysolepis sempervirens-Quercus vaccinifolia-Arctostaphylos nevadensis) Forest Superassociation* | < | California Red Fir/Woolly Mule-ears Forest | *Abies magnifica*/*Wyethia mollis* Forest |
| | | | < | California Red Fir-Western White Pine/Bush Chinquapin Forest | *Abies magnifica-Pinus monticola*/*Chrysolepis sempervirens* Forest |
| | | | < | California Red Fir-Western White Pine/Huckleberry Oak Forest | *Abies magnifica-Pinus monticola*/*Quercus vaccinifolia* Forest |
| | | | < | California Red Fir-Western White Pine/Pinemat Manzanita Forest | *Abies magnifica-Pinus monticola*/*Arctostaphylos nevadensis* Forest |
| 4070 | California Red Fir-White Fir Forest Alliance | *Abies magnifica-Abies concolor* Forest Alliance | > | California Red Fir-White Fir Forest Alliance | *Abies magnifica-Abies concolor* Forest Alliance |
| | | | < | California Red Fir-White Fir Forest | *Abies magnifica-Abies concolor* Forest |
| | | | < | California Red Fir-White Fir-Jeffrey Pine Forest | *Abies magnifica-Abies concolor-Pinus jeffreyi* Forest |
| | | | < | White Fir-Sugar Pine-California Red Fir Forest | *Abies concolor-Pinus lambertiana-Abies magnifica* Forest |
| 4085 | White Fir Eastside Mapping Unit | Abies concolor Eastside Mapping Unit | | None | None |
| 4520 | White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/(Pinemat Manzanita- | *Abies concolor-(Abies magnifica-Pinus lambertiana-Pinus* | < | California Red Fir/Pinemat Manzanita Forest | *Abies magnifica*/*Arctostaphylos nevadensis* Forest |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | Whitethorn Ceanothus) Forest Mapping Unit | *jeffreyi*)/(*Arctostaphylos nevadensis-Ceanothus cordulatus*) Mapping Unit | < | White Fir-Sugar Pine/Whitethorn Ceanothus Forest | *Abies concolor-Pinus lambertiana*/*Ceanothus cordulatus* Forest |
| 4530 | White Fir–Sugar Pine-(Incense-cedar-Jeffrey Pine) Forest Mapping Unit | *Abies concolor-Pinus lambertiana*-(*Calocedrus decurrens-Pinus jeffreyi*) Forest Mapping Unit | < | Jeffrey Pine-White Fir Woodland | *Pinus jeffreyi-Abies concolor* Forest |
| | | | < | White Fir-Sugar Pine Forest Alliance | *Abies concolor-Pinus lambertiana* Forest Alliance |
| | | | < | White Fir-Sugar Pine Forest | *Abies concolor-Pinus lambertiana* Forest |
| | | | < | White Fir-Sugar Pine-Jeffrey Pine Forest | *Abies concolor-Pinus lambertiana-Pinus jeffreyi* Forest |
| | | | < | White Fir-Incense-cedar-Sugar Pine/Trail Plant Forest | *Abies concolor-Calocedrus decurrens-Pinus lambertiana*/*Adenocaulon bicolor* Forest |
| | | | < | White Fir-Incense-cedar-Sugar Pine-Pacific Dogwood/California Hazel Forest | *Abies concolor-Calocedrus decurrens-Cornus nuttallii*/*Corylus cornuta* var. *californica* Forest |
| | | | < | White Fir-Sugar Pine/False Solomon's- Seal-Drops of Gold Forest | *Abies concolor-Pinus lambertiana-Maianthemum racemosum-Disporum hookeri* Forest |
| | | | < | White Fir-Sugar Pine-Incense-cedar/Bush Chinquapin Forest | *Abies concolor-Pinus lambertiana-Calocedrus decurrens*/*Chrysolepis sempervirens* Forest |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | White Fir-Sugar Pine-Incense-cedar/Creeping Snowberry/Milky Kelloggia Forest | *Abies concolor-Pinus lambertiana-Calocedrus decurrens*/*Symphoricarpos mollis*/*Kelloggia galioides* Forest |
| 4100 | Sierra Juniper Woodland Alliance | *Juniperus occidentalis* Woodland Alliance | = | Sierra Juniper Woodland Alliance | *Juniperus occidentalis* Woodland Alliance |
| | | | < | Sierra Juniper/Big Sagebrush Woodland | *Juniperus occidentalis* var. *australis/Artemisia tridentata* Woodland |
| 4101 | Sierra Juniper/(Oceanspray) Woodland Superassociation | *Juniperus occidentalis* var. *australis*/(*Holodiscus discolor*) Woodland Superassociation | | None | None |
| | | | < | Sierra Juniper Woodland | *Juniperus occidentalis* var. *australis* Woodland |
| | | | < | Sierra Juniper/Oceanspray Woodland | *Juniperus occidentalis* var. *australis/Holodiscus discolor* Woodland |
| | | | < | Sierra Juniper/Pinemat Manzanita Woodland (phase) | *Juniperus occidentalis* var. *australis/Arctostaphylos nevadensis* Woodland |
| 4107 | Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland Association | *Juniperus occidentalis* var. *australis-Cercocarpus ledifolius/Artemisia tridentata* Woodland Association | = | Sierra Juniper-Curl-leaf Mountain Mahogany/Big Sagebrush Woodland | *Juniperus occidentalis* var. *australis-Cercocarpus ledifolius/Artemisia tridentata* Woodland |
| 4111 | Incense-cedar-White Alder Forest Association | *Calocedrus decurrens-Alnus rhombifolia* Forest Association | = | Incense-cedar-White Alder Forest | *Calocedrus decurrens-Alnus rhombifolia* Forest |
| 5021 | Chamise Shrubland Association | *Adenostoma fasciculatum* Shrubland Association | = | Chamise Shrubland | *Adenostoma fasciculatum* Shrubland |
| 5041 | Interior Live Oak-California Buckeye Shrubland Association | *Quercus wislizeni-Aesculus californicus Shrubland Association* | > | Interior Live Oak Shrubland Alliance | *Quercus wislizeni* Shrubland Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 5060 | Chaparral Whitethorn Shrubland Alliance | *Ceanothus leucodermis* Shrubland Alliance | = | Chaparral Whitethorn Shrubland Alliance | *Ceanothus leucodermis* Shrubland Alliance |
| | | | < | Chaparral Whitethorn-Poison Oak Shrubland | *Ceanothus leucodermis-Toxicodendron diversilobum* Shrubland |
| 5110 | Whitethorn Ceanothus Shrubland Alliance | *Ceanothus cordulatus* Shrubland Alliance | = | Whitethorn Ceanothus Shrubland Alliance | *Ceanothus cordulatus* Shrubland Alliance |
| | | | < | Whitethorn Ceanothus Shrubland | *Ceanothus cordulatus* Shrubland |
| 5120 | Snowbrush Ceanothus Shrubland Alliance | *Ceanothus velutinus* Shrubland Alliance | = | Snowbrush Ceanothus Shrubland Alliance | *Ceanothus velutinus* Shrubland Alliance |
| | | | < | Snowbrush Ceanothus-Bitter Cherry Shrubland | *Ceanothus velutinus-Prunus emarginata* Shrubland |
| 5130 | Mountain Misery Dwarf-shrubland Alliance | *Chamaebatia foliolosa* Dwarf-shrubland Alliance | = | Mountain Misery Dwarf-shrubland Alliance | *Chamaebatia foliolosa* Dwarf-shrubland Alliance |
| 5160 | Big Sagebrush Shrubland Alliance | *Artemisia tridentata* ssp. *tridentata* Shrubland Alliance | = | Big Sagebrush Shrubland Alliance | *Artemisia tridentata* ssp. *tridentata Shrubland Alliance* |
| | | | < | Big Sagebrush-Rubber Rabbitbrush Shrubland | *Artemisia tridentata* ssp. *tridentata-Ericameria nauseosa Shrubland* |
| | | | < | Big Sagebrush/Indian Ricegrass Shrubland | *Artemisia tridentata* ssp. *tridentata/Achnatherum hymenoides Shrubland* |
| 5210 | Low Sagebrush Dwarf-shrubland Alliance | *Artemisia arbuscula* Dwarf-shrubland Alliance | = | Low Sagebrush Dwarf-shrubland Alliance | *Artemisia arbuscula* Dwarf-shrubland Alliance |
| | | | < | Low Sagebrush/Slender Buckwheat Dwarf-shrubland | *Artemisia arbuscula/Eriogonum microthecum* Dwarf-shrubland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | Low Sagebrush/Prickly Phlox Dwarf-shrubland | *Artemisia arbuscula*/*Leptodactylon pungens* Dwarf-shrubland |
| 5230 | Curl-leaf Mountain Mahogany Woodland Alliance | *Cercocarpus ledifolius* Woodland Alliance | = | Curl-leaf Mountain Mahogany Woodland Alliance | *Cercocarpus ledifolius* Woodland Alliance |
| | | | < | Curl-leaf Mountain Mahogany/Roundleaf Snowberry Woodland | *Cercocarpus ledifolius*/*Symphoricarpos rotundifolius* Woodland |
| 5240 | Antelope Bitterbrush Shrubland Alliance | *Purshia tridentata* Shrubland Alliance | = | Antelope Bitterbrush Shrubland Alliance | *Purshia tridentata* Shrubland Alliance |
| | | | < | Antelope Bitterbrush-Big Sagebrush-Spineless Horsebrush Shrubland | *Purshia tridentata-Artemisia tridentata-Tetradymia canescens* Shrubland |
| | | | < | Antelope Bitterbrush-Big Sagebrush/Indian Ricegrass Shrubland | *Purshia tridentata-Artemisia tridentata*/*Achnatherum hymenoides* Shrubland |
| | | | < | Antelope Bitterbrush-Big Sagebrush/Nevada Needlegrass-(Dore's Needlegrass) Shrubland | *Purshia tridentata-Artemisia tridentata*/*Achnatherum nevadense*-(*Achnatherum nelsonii* ssp. *dorei*) Shrubland |
| | | | < | Antelope Bitterbrush-Big Sagebrush-Roundleaf Snowberry Shrubland | *Purshia tridentata-Artemisia tridentata-Symphoricarpos rotundifolius* Shrubland |
| 5250 | (Silver Lupine)/Brome spp. Shrubland Mapping Unit | (*Lupinus albifrons*)/*Bromus* spp. Shrubland Mapping Unit | < | Silver Lupine Shrubland Alliance | *Lupinus albifrons* Shrubland Alliance |
| | | | < | Silver Lupine Shrubland | *Lupinus albifrons* Shrubland |
| 5260 | Big Sagebrush-(Silver Sagebrush) Shrubland Mapping Unit | *Artemisia tridentata* ssp. *tridentata*-(*Artemisia cana*) Shrubland Mapping Unit | < | Silver Sagebrush Shrubland Alliance | *Artemisia cana* Shrubland Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | Big Sagebrush Shrubland Alliance | *Artemisia tridentata* ssp. *tridentata* Shrubland Alliance |
| 5510 | Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance | *Artemisia tridentata* ssp. *vaseyana* & *Artemisia rothrockii* & *Holodiscus discolor* & *Phyllodoce breweri* Shrubland Superalliance | < | Mountain Big Sagebrush Shrubland Alliance | *Artemisia tridentata* ssp. *vaseyana* Shrubland Alliance |
| | | | < | Mountain Big Sagebrush/Shorthair Sedge Shrubland | *Artemisia tridentata* ssp. *vaseyana*/Carex exserta Shrubland |
| | | | < | Mountain Big Sagebrush/Mountain Pennyroyal Shrubland | *Artemisia tridentata* ssp. *vaseyana*/*Monardella odoratissima* Shrubland |
| | | | < | Timberline Sagebrush Dwarf-shrubland Alliance | *Artemisia rothrockii* Dwarf-shrubland Alliance |
| | | | < | Oceanspray Shrubland Alliance | *Holodiscus discolor* Shrubland Alliance |
| | | | < | Red Mountainheather Shrubland Alliance | *Phyllodoce breweri* Shrubland Alliance |
| 5560 | Chamise–(Buckbrush–Whiteleaf Manzanita) Shrubland Mapping Unit | *Adenostoma fasciculatum*-(*Ceanothus cuneatus*-*Arctostaphylos viscida*) Shrubland Mapping Unit | < | Chamise-Whiteleaf Manzanita Shrubland | *Adenostoma fasciculatum*-*Arctostaphylos viscida* Shrubland |
| | | | < | Chamise-Buckbrush Shrubland Alliance | *Adenostoma fasciculatum*-*Ceanothus cuneatus* Shrubland Alliance |
| | | | < | Chamise-Buckbrush Shrubland | *Adenostoma fasciculatum*-*Ceanothus cuneatus* Shrubland |
| 5570 | Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Superalliance | *Arctostaphylos patula* & *Chrysolepis sempervirens* & *Quercus vaccinifolia* Shrubland Superalliance | < | Bush Chinquapin Shrubland Alliance | *Chrysolepis sempervirens* Shrubland Alliance |
| | | | < | Greenleaf Manzanita Shrubland Alliance | *Arctostaphylos patula* Shrubland Alliance |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | Huckleberry Oak-Greenleaf Manzanita Shrubland | *Quercus vaccinifolia-Arctostaphylos patula* Shrubland |
| | | | < | Huckleberry Oak Shrubland Alliance | *Quercus vaccinifolia* Shrubland Alliance |
| | | | < | Huckleberry Oak-Bush Chinquapin Shrubland | *Quercus vaccinifolia-Chrysolepis sempervirens* Shrubland |
| | | | < | Huckleberry Oak Shrubland | *Quercus vaccinifolia* Shrubland |
| 5580 | Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance | *Cercocarpus montanus* & *Ceanothus cuneatus* & *Arctostaphylos viscida* Shrubland Superalliance | < | Birchleaf Mountain Mahogany Shrubland Alliance | *Cercocarpus montanus* Shrubland Alliance |
| | | | < | Birchleaf Mountain Mahogany Shrubland | *Cercocarpus montanus* Shrubland |
| | | | < | Buckbrush Shrubland Alliance | *Ceanothus cuneatus* Shrubland Alliance |
| | | | < | Buckbrush/Grass Shrubland | *Ceanothus cuneatus*/Grass Shrubland |
| | | | < | Whiteleaf Manzanita Shrubland Alliance | *Arctostaphylos viscida* Shrubland Alliance |
| | | | < | Whitleaf Manzanita Shrubland | *Arctostaphylos viscida* Shrubland |
| 6010 | Deerbrush Shrubland Alliance | *Ceanothus integerrimus* Shrubland Alliance | = | Deerbrush Shrubland Alliance | *Ceanothus integerrimus* Shrubland Alliance |
| | | | < | Deerbrush-Whitethorn Ceanothus Shrubland | *Ceanothus integerrimus-Ceanothus cordulatus* Shrubland |
| 6012 | Deerbrush-Whiteleaf Manzanita Shrubland Association | *Ceanothus integerrimus-Arctostaphylos viscida* Shrubland Association | = | Deerbrush-Whiteleaf Manzanita Shrubland | *Ceanothus integerrimus-Arctostaphylos viscida* Shrubland |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| 6020 | Oregon White Oak Shrubland Alliance | *Quercus garryana* var. *breweri* Shrubland Alliance | = | Oregon White Oak Shrubland Alliance | *Quercus garryana* var. *breweri* Shrubland Alliance |
| 6110 | Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance | *Salix orestera*/*Allium validum* Seasonally Flooded Shrubland Alliance | = | Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance | *Salix orestera*/*Allium validum* Seasonally Flooded Shrubland Alliance |
| | | | < | Sierra Willow/Swamp Onion Shrubland | *Salix orestera*/*Allium validum* Shrubland |
| | | | < | Sierra Willow/Arrowleaf Groundsel Shrubland | *Salix orestera*/*Senecio triangularis* Shrubland |
| | | | < | Sierra Willow/Shorthair Reedgrass Shrubland | *Salix orestera*/*Calamagrostis breweri* Shrubland |
| 6500 | Willow spp./Meadow Shrubland Mapping Unit | *Salix* spp./Meadow Shrubland Mapping Unit | | None | None |
| 6600 | Willow spp. Riparian Shrubland Mapping Unit | *Salix* spp. Riparian Shrubland Mapping Unit | | None | None |
| 6700 | Willow spp. Talus Shrubland Mapping Unit | *Salix* spp. Talus Shrubland Mapping Unit | | None | None |
| 6900 | Mesic Montane Shrubland Mapping Unit | Mesic Montane Shrubland Mapping Unit | < | Bitter Cherry Shrubland Alliance | *Prunus emarginata* Shrubland Alliance |
| 7120 | Shorthair Sedge Herbaceous Alliance | *Carex exserta* Herbaceous Alliance | ↔ | Shorthair Sedge Herbaceous Alliance | *Carex exserta* Herbaceous Alliance |
| | | | < | Shorthair Sedge-Pussypaws Herbaceous Vegetation | Carex exserta-*Cistanthe umbellata* Herbaceous Vegetation |
| | | | < | Shorthair Sedge-Spike Trisetum Herbaceous Vegetation | Carex exserta-*Trisetum spicatum* Herbaceous Vegetation |

| Map Code (PIFinal) | Mapping Classification Common Name | Mapping Class Scientific Name | | Vegetation Classification Common Name | Vegetation Classification Scientific Name |
|---|---|---|---|---|---|
| | | | < | Shorthair Sedge-Sierra Beardtongue Herbaceous Vegetation | *Carex exserta-Penstemon heterodoxus* Herbaceous Vegetation |
| 7260 | California Annual Grassland/Herbland Superalliance | California Annual Grassland/Herbland Superalliance | < | (Ripgut Brome, Soft Chess, Spanish Brome) Herbaceous Alliance (California Annual Grassland Alliance) | Bromus (diandrus, hordeaceus, madritensis) Herbaceous Alliance (California Annual Grassland Alliance) |
| | | | < | Ripgut Brome-Soft Chess-Annual Clover-American Wild Carrot Herbaceous Vegetation | |
| | | | < | California Annual Herbland Alliance | |
| 7550 | Upland Graminoids | Upland Graminoids | | None | None |
| 7701 | Post-clearcut Shrub/Herbaceous Mapping Unit | Post-clearcut Shrub/Herbaceous Mapping Unit | | None | None |
| 7702 | Mesic Post Fire Herbaceous Mapping Unit | Mesic Post Fire Herbaceous Mapping Unit | | None | None |
| 8000 | Intermittently to Seasonally Flooded Meadow | Intermittently to Seasonally Flooded Meadow | | None | None |
| 9000 | Semi-permanently to Permanently Flooded Meadow | Semi-permanently to Permanently Flooded Meadow | | None | None |

# Appendix Q: Estimated Mapping Accuracies at the Association Level or Equivalent

The following table displays estimated accuracies for mapped vegetation types for which accuracy assessment data were collected in 2002-2003*. Accuracy estimates presented are for user's accuracy, that is, the probability that a sample from the classified data actually represents that category on the ground. Alternately, user's accuracy indicates the probability that a sample from the field matches the photo-interpreted vegetation type. It is calculated as the number of samples classified correctly divided by the total number of accuracy assessment points mapped as that class multiplied by 100. It measures the error of commission (1- user's accuracy). PI Code is the photointerpretation code assigned to polygons in the map. Additional details , including types not assessed for accuracy, are available in the full contingency tableat the NPS Vegetation Inventory Program web page (http://science.nature.nps.gov/im/inventory/veg/index.cfm).

| Mapping Unit Name | PI Code | Number AA Pts Correct | Total Number AA Pts | % correct (Users) |
|---|---|---|---|---|
| Canyon Live Oak Forest Alliance | 1020 | 31 | 36 | 86 |
| Canyon Live Oak/Whiteleaf Manzanita Forest Association | 1022 | 15 | 22 | 68 |
| Canyon Live Oak-(Ponderosa Pine-Incense-cedar) Forest Superassociation | 1023 | 11 | 14 | 78 |
| Canyon Live Oak-California Laurel Forest Superassociation | 1024 | 27 | 32 | 84 |
| Canyon Live Oak/Greenleaf Manzanita Forest Association | 1029 | 9 | 11 | 81 |
| Interior Live Oak Woodland Alliance | 1040 | 13 | 17 | 76 |
| Interior Live Oak-Canyon Live Oak Woodland Association | 1043 | 8 | 10 | 80 |
| Canyon Live Oak/California Buckeye Woodland & Interior Live Oak-California Buckeye Shrubland Mapping Unit | 1510 | 14 | 16 | 87 |
| Blue Oak-(Interior Live Oak-Gray Pine/Buckbrush/Annual Grass) Woodland Mapping Unit | 1520 | 6 | 14 | 42 |
| Quaking Aspen Forest Alliance | 2010 | 28 | 31 | 90 |
| Quaking Aspen /California False Hellebore Forest Association | 2011 | 6 | 6 | 100 |
| Quaking Aspen/Willow spp. Forest Mapping Unit | 2013 | 12 | 15 | 80 |
| Quaking Aspen/Willow spp. Talus Mapping Unit | 2014 | 11 | 15 | 73 |
| Quaking Aspen-Jeffery Pine/(Big Sagebrush) Forest Association | 2015 | 9 | 10 | 90 |
| Quaking Aspen-/Big Sagebrush Forest Superassociation | 2016 | 17 | 22 | 77 |
| California Black Oak Forest Alliance | 2020 | 24 | 27 | 88 |
| California Black Oak/Greenleaf Manzanita Forest Association | 2021 | 12 | 15 | 80 |
| California Black Oak/(Bracken Fern) Forest Mapping Unit | 2025 | 7 | 8 | 87 |
| Black Cottonwood Temporarily Flooded Forest Alliance | 2050 | 8 | 11 | 72 |
| Black Cottonwood-Quaking Aspen (Jeffery Pine)/Willow spp. Mapping Unit | 2052 | 3 | 3 | 100 |
| Willow spp. Forest Mapping Unit | 2510 | 1 | 1 | 100 |
| White Alder & Bigleaf Maple Forest Superalliance | 2520 | 11 | 12 | 91 |
| Sierra Lodgepole Pine-Quaking Aspen-(Jeffrey Pine) Forest Mapping Unit | 3010 | 18 | 23 | 78 |
| Sierra Lodgepole Pine-Quaking Aspen/(Kentucky Bluegrass) Forest Mapping Unit | 3012 | 8 | 9 | 88 |
| Sierra Lodgepole Pine Forest Alliance | 3020 | 15 | 16 | 93 |
| Sierra Lodgepole Pine/(Bog Blueberry) Forest Mapping Unit | 3022 | 28 | 37 | 75 |
| Sierra Lodgepole Pine Woodlands Superassociation | 3026 | 66 | 77 | 85 |
| Sierra Lodgepole Pine/(Big Sagebrush-Roundleaf Snowberry-Current-Red Mountain Heather) Forest Mapping Unit | 3027 | 13 | 16 | 81 |

| Mapping Unit Name | PI Code | Number AA Pts Correct | Total Number AA Pts | % correct (Users) |
|---|---|---|---|---|
| Sierra Lodgepole Pine-(Whitebark Pine)/(Ross Sedge-Shorthair Sedge) Forest Superassociation | 3028 | 52 | 66 | 78 |
| Sierra Lodgepole Pine/(Big Sagebrush)/(Kentucky Bluegrass) Mapping Unit | 3047 | 9 | 10 | 90 |
| Sierra Lodgepole Pine Mesic Forest Superassociation | 3048 | 26 | 32 | 81 |
| Sierra Lodgepole Pine Xeric Forest Superassociation | 3049 | 15 | 18 | 83 |
| Ponderosa Pine Woodland Alliance | 3050 | 13 | 16 | 81 |
| Ponderosa Pine-California Black Oak/Whiteleaf Manzanita Woodland Association | 3053 | 21 | 24 | 87 |
| Ponderosa Pine-Incense-cedar Forest Alliance | 3060 | 19 | 23 | 82 |
| Ponderosa Pine-Incense-cedar-(California Black Oak-Canyon Live Oak) Forest Superassociation | 3066 | 71 | 82 | 86 |
| Jeffrey Pine Woodland Alliance | 3070 | 19 | 22 | 86 |
| Jeffrey Pine/Greenleaf Manzanita Woodland Association | 3072 | 27 | 30 | 90 |
| Jeffrey Pine/Mountain Whitethorn Ceanothus Woodland Association | 3073 | 9 | 11 | 81 |
| Jeffrey Pine/Huckleberry Oak Woodland Association | 3075 | 21 | 26 | 80 |
| Jeffrey Pine/Antelope Bitterbrush Woodland Association | 3076 | 13 | 15 | 86 |
| Jeffrey Pine-Singleleaf Pinyon Pine Woodland Association | 3081 | 2 | 2 | 100 |
| Jeffery Pine/Curl-leaf Mountain Mahogany Woodland Association | 3082 | 9 | 10 | 90 |
| Jeffrey Pine-White Fir/Roundleaf Snowberry/Squirreltail Woodland Association | 3083 | 8 | 10 | 80 |
| Jeffrey Pine-Canyon Live Oak/Whiteleaf Manzanita Woodland Association | 3084 | 14 | 19 | 73 |
| Jeffrey Pine-California Red Fir Woodland Association | 3085 | 7 | 25 | 28 |
| Gray Pine Woodland Alliance | 3090 | 6 | 7 | 85 |
| Gray Pine-Interior Live Oak/(Whiteleaf Manzanita-Buckbrush-Chamise) Woodland Superassociation | 3097 | 23 | 31 | 74 |
| Knobcone Pine/Whiteleaf Manzanita Woodland Association | 3101 | 8 | 8 | 100 |
| Knobcone Pine-Canyon Live Oak Woodland Mapping Unit | 3102 | 8 | 8 | 100 |
| Knobcone Pine/Chamise Woodland Association | 3105 | 3 | 4 | 75 |
| Single-leaf Pinyon Pine/Curl-leaf Mountain Mahogany-Big Sagebrush-Antelope Bitterbrush Woodland Association | 3112 | 9 | 10 | 90 |
| Single-leaf Pinyon Pine/(Desert Gooseberry-Big Sagebrush/Squirreltail) Woodland Association | 3113 | 11 | 14 | 78 |
| Western White Pine/Western Needlegrass Woodland Mapping Unit | 3131 | 22 | 28 | 78 |
| Whitebark Pine Woodland Alliance | 3140 | 12 | 15 | 80 |
| Whitebark Pine/(Ross Sedge-Shorthair Sedge) Woodland Superassociation | 3143 | 41 | 48 | 85 |
| Whitebark Pine-Mountain Hemlock Woodland Association | 3147 | 30 | 38 | 78 |
| Whitebark Pine -(Sierra LodgepolePine-Mountain Hemlock) Krummholz Conifer Mapping Unit | 3149 | 21 | 26 | 80 |
| Douglas-fir -Canyon Live Oak Forest Association | 4012 | 12 | 15 | 80 |
| Douglas-fir-White Alder Forest Association | 4014 | 4 | 4 | 100 |
| Mountain Hemlock-(Western White Pine-Sierra Lodgepole Pine) Forest Superassociation | 4035 | 79 | 92 | 85 |
| California Red Fir-(Sierra Lodgepole Pine) Forest Superassociation | 4056 | 60 | 75 | 80 |

| Mapping Unit Name | PI Code | Number AA Pts Correct | Total Number AA Pts | % correct (Users) |
|---|---|---|---|---|
| California Red Fir-(Western White Pine)/(Bush Chinquapin-Huckleberry Oak-Pinemat Manzanita) Forest Superassociation | 4069 | 16 | 29 | 55 |
| California Red Fir-White Fir Forest Alliance | 4070 | 53 | 76 | 69 |
| Sierra Juniper Woodland Alliance | 4100 | 35 | 39 | 89 |
| Sierra Juniper/Curl-leaf Mountain Mahogany-Big Sagebrush Woodland Association | 4107 | 14 | 15 | 93 |
| Incense-cedar-White Alder Forest Association | 4111 | 8 | 8 | 100 |
| Western White Pine-(California Red Fir-Sierra Lodgepole Pine) Foret Superalliance | 4510 | 56 | 75 | 74 |
| White Fir-(California Red Fir-Sugar Pine-Jeffrey Pine)/(Pinemat Manzanita-Whitethorn Ceanothus) Forest Mapping Unit | 4520 | 28 | 37 | 75 |
| White Fir-Sugar Pine-(Incense-cedar-Jeffrey Pine) Mapping Unit | 4530 | 64 | 82 | 78 |
| Douglas-fir-(White Fir-Incense-cedar-Ponderosa Pine) Forest Mapping Unit | 4550 | 20 | 26 | 76 |
| Chamise Shrubland Association | 5021 | 7 | 8 | 87 |
| Interior Live Oak-California Buckeye Shrubland Association | 5041 | 6 | 8 | 75 |
| Whitethorn Ceanothus Shrubland Alliance | 5110 | 19 | 26 | 73 |
| Tobacco Brush Shrubland Alliance | 5120 | 14 | 15 | 93 |
| Mountain Misery-Manzanita spp. Mapping Unit | 5131 | 13 | 15 | 86 |
| Big Sagebrush Shrubland Alliance | 5160 | 17 | 22 | 77 |
| Low Sagebrush Dwarf-shrubland Alliance | 5210 | 25 | 30 | 83 |
| Curl-leaf Mountain Mahogany Woodland Alliance | 5230 | 35 | 37 | 94 |
| Antelope Bitterbrush Shrubland Alliance | 5240 | 29 | 35 | 82 |
| (Silverbush Lupine)/Brome spp. Shrubland Mapping Unit | 5250 | 4 | 4 | 100 |
| Mountain Big Sagebrush & Timberline Sagebrush & Oceanspray & Red Mountainheather Shrubland Superalliance | 5510 | 20 | 24 | 83 |
| Chamise-(Buckbrush-Whiteleaf Manzanita) ShrublandMapping Unit | 5560 | 18 | 24 | 75 |
| Greenleaf Manzanita & Bush Chinquapin & Huckleberry Oak Shrubland Mapping Unit | 5570 | 58 | 72 | 80 |
| Birchleaf Mountain Mahogany & Buckbrush & Whiteleaf Manzanita Shrubland Superalliance | 5580 | 24 | 27 | 88 |
| Deerbrush Shrubland Alliance | 6010 | 8 | 10 | 80 |
| Deerbrush-Whiteleaf Manzanita Shrubland Association | 6012 | 11 | 15 | 73 |
| Sierra Willow/Swamp Onion Seasonally Flooded Shrubland Alliance | 6110 | 2 | 2 | 100 |
| Mesic Montane Shrubland Mapping Unit | 6900 | 9 | 13 | 69 |
| California Annual Grassland/Herbland Superalliance | 7260 | 7 | 8 | 87 |
| Intermittently to Seasonally Flooded Meadow Mapping Unit | 8000 | 3 | 3 | 100 |
| **Totals and Global Accuracy** | | **1758** | **2175** | **81** |

# Appendix R: Metadata

Complete metadata are available with the digital map file which is available through the USGS Vegetation Inventory Program web page (http://science.nature.nps.gov/im/inventory/veg/index.cfm), including coordinate system (NAD_1983_UTM_Zone_11N) and bounding coordinates. Below is the attribute definition portion of the metadata.

| Field Name | Data Type | Definition |
|---|---|---|
| FID | OID | Internal feature number. |
| Shape | Geometry | Feature geometry |
| OBJECTID | Numeric | |
| PIFINAL | Numeric | Final code for vegetation class. Comprehensive list of PIFinal codes is available in Appendix H. |
| PIPREFINAL | Numeric | Code for vegetation class prior to accuracy assessment and aggregation of classes |
| PIORIGINAL | Numeric | Original photointerpretation code assigned to the polygon |
| DENSITY | Numeric | Density of vegetative cover:<br>1 = Greater than 60%<br>2 = 40-60%<br>3 = 25-40%<br>4 = 10-25%<br>5 = 2-10 %<br>6 = Trace amounts less than 2% (used for talus & scree) |
| FIRE | Numeric | 1 = High severity<br>2 = Moderate severity<br>3 = Low severity<br>9 = No modifier |
| LANDUSE | Numeric | General land use categories. Codes represent a modified Anderson et al. (1976) level 3 classification. Full list of codes is available in Appendix O, mapping classification descriptions, under 0990 Urban/Developed. |
| SHAPE_LENG | Numeric | Length of polygon perimeter (m) |
| SHAPE_AREA | Numeric | Area of feature in internal units squared (m sq) |
| VEGETATION | String | Name of final vegetation type (alliance or association) assigned |

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**National Park Service**
**U.S. Department of the Interior**

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