Ecology of Greater Sage-Grouse in the Bi-State Planning Area

Progress Report
March 2005

Prepared by Michael L. Casazza[1], Cory T. Overton[1], and Alicia Torregrosa[2]
[1]Western Ecological Research Center, USGS, 6924 Tremont Rd. Dixon, CA 95620
[2]Western Geographic Science Center, Menlo Park, CA

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Bi-State Sage Grouse Conservation Planning and Ecology

A recent finding by the USFWS (Wyoming Field Office, 2005) that listing of the greater sage-grouse (*Centrocercus urophasianus*) under the Endangered Species Act is not warranted at this time was based in part on the fact that numerous local conservation plans (as many as 70) are in various stages of development across this species' range. In addition to the finding of the US Fish and Wildlife Service, a range-wide assessment was also completed (Connelly et al. 2004) which summarized the current state of knowledge regarding sage grouse and sage brush habitats across the West. Both of these documents provide insight into the current status of sage grouse from a range-wide prospective. The work presented in this progress report represents a summary of field research conducted from the spring of 2003 to present. This is in support of the local efforts to conserve sage grouse in Mono County, CA as part of the ongoing Bi-State Local Area Working Group and the Nevada Governor's Sage Grouse Conservation Strategy.

The Bi-State local planning area includes populations of sage grouse along the California-Nevada border, in and surrounding Mono County. Local populations have been described and placed into 6 population management units (PMU's): including Desert Creek/Fales, Bodie Hills, South Mono Basin (includes Long Valley), Pine Nut, White Mountains, and Mt. Grant. Local population risk assessment and conservation strategies have been developed in each PMU and a "First Edition" of the Bi-State Conservation Plan was submitted in June 2004 (Bi-State, 2004). This is a consensus-built conservation plan developed by local working groups including federal, state, and local regulatory and land-management agencies, non-government organizations, ranchers, private landowners, and Native American tribes.

The USGS has participated in the conservation planning process over the past two years through a variety of means. USGS scientists have attended both Bi-State and local PMU planning meetings and presented scientific findings and results from ongoing field studies of sage grouse biology to these local working groups. The USGS has facilitated the "South Mono PMU Group" and has provided technical assistance as needed to other local PMU groups. We will continue to help facilitate the planning and implementation process as the Bi-State Conservation Plan continues to develop and be implemented.

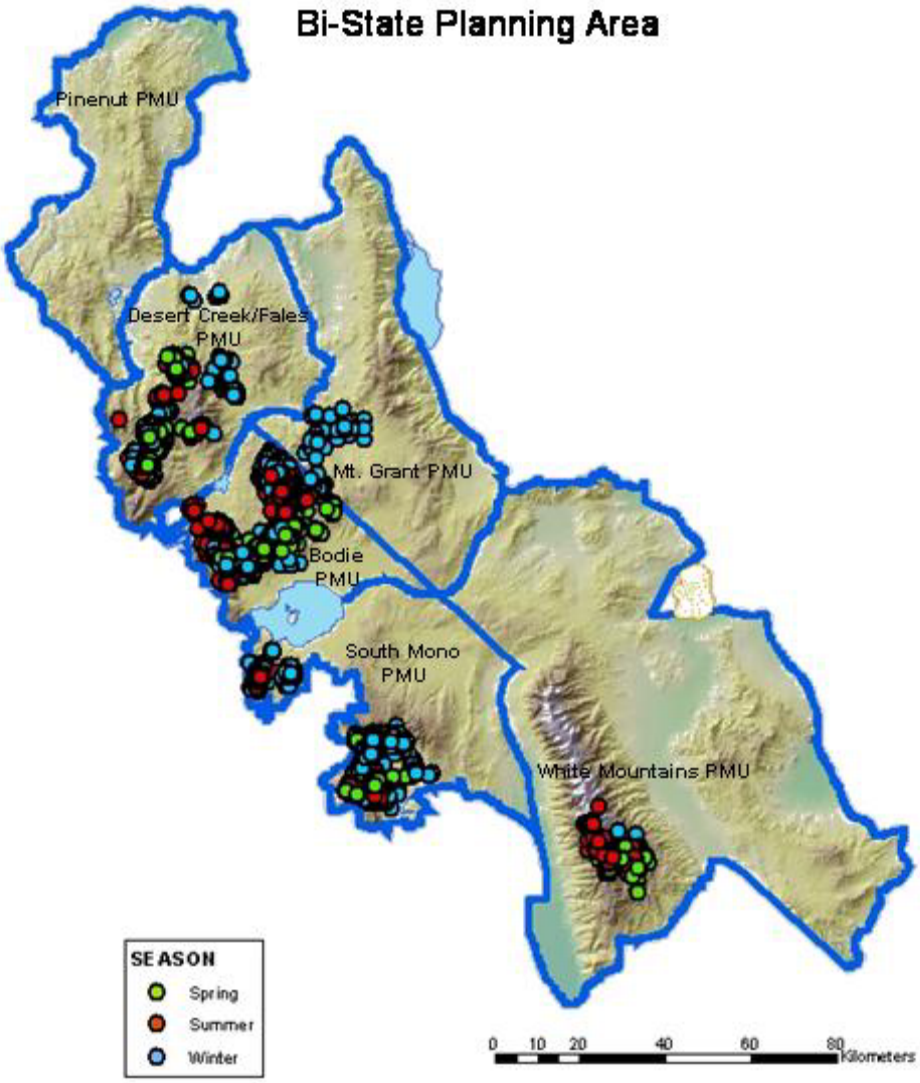
Beginning in spring 2003 the USGS initiated field studies aimed at filling information needs for greater sage grouse in the region. Individual sage grouse were radio-marked at several locations throughout the Bi-State planning area and field crews monitored bird movements, habitat use and survival on an annual basis. We monitored 136 individual radio-marked sage grouse marked at 6 capture sites (Table 1).

Table 1. Number of radio–marked individual sage grouse reported by capture site.

Capture Site	Female	Male	Total
Jackass	16	5	21
Fales	12	7	19
Bodie	26	9	35
Parker	9	3	12
Long Valley	16	9	25
White Mountains	17	7	24
Total	96	40	136

Since that time, almost 7,000 telemetry data points have been gathered to delineate seasonal use areas and migratory patterns. The telemetry dataset and corresponding metadata, has been incorporated into the BIOS database, which is maintained by the California Department of Fish and Game. Sage grouse were radio-marked in Mono County but have been subsequently located in several areas within Nevada including the Mt. Grant PMU and the Desert Creek portion of the Desert Creek/Fales PMU (Figure 1).

Figure 1. Telemetry locations for sage grouse in the Bi-State Planning Area.



Radio-marked sage grouse had varying home range sizes, but the largest home ranges on average were in the Bodie Hills followed by Long Valley, Burcham, Jackass, with the smallest home ranges found at Parker (Table 2). The one male marked at Wheeler Flat that we were able to calculate a home range for was very small (608 ha).

Table 2. Annual home range sizes for radio-marked sage grouse by capture site and sex. Home ranges were calculated for each bird having at least 30 telemetry locations and at least 5 points in each of three seasons (Spring = April-June; Summer = July – October; Winter = November – March) using the fixed kernel method.

Capture Site	N	Sex	Year	Area (ha)	Min Area (ha)	Max Area (ha)
Jackass	5	F	03-04	1334	263	3597
Jackass	4	F	04-05	5740	3263	10443
Burcham	1	F	03-04	1741	1741	1741
Burcham	1	F	04-05	3447	3447	3447
Wheeler	1	M	04-05	608	608	608
Bodie	1	F	03-04	9096	9096	9096
Bodie	5	F	04-05	7585	2601	13814
Bodie	2	M	03-04	20936	17071	24801
Parker	2	F	03-04	1352	723	1981
Parker	2	F	04-05	1676	1260	2091
Parker	2	M	03-04	2230	2144	2315
Parker	1	M	04-05	1173	1173	1173
Long Valley	9	F	03-04	3473	1010	4994
Long Valley	4	F	04-05	2996	1548	4128
Long Valley	3	M	04-05	3643	2485	4954

We recovered all radio-marked birds that died and classified the cause of death based on multiple factors found at each scene including animal tracks, condition of carcass, nearby scat, location or presence of feathers, bones etc. Beginning in 2004 we also sent remains to the National Wildlife Health Center to be tested for West Nile Virus

(WNV). Results from recovered grouse indicate multiple sources of mortality (Table 3). Both avian and mammalian predation played a key role in grouse mortality, while West Nile Virus became an issue in 2004 with 3 carcasses testing positive.

Table 3. Mortality causes for radio-marked sage grouse recorded by population management unit.

PMU	Number of birds					
	Avian Predator	Mammalian Predator	Unknown Predator	Unknown	Handling Related	West Nile Virus
Desert Creek/Fales	5	7	7	5	0	1
Bodie	6	2	5	1	1	2
South Mono	4	8	4	1	2	0
White Mountains	5	1	1	1	0	0
Total	20	18	17	8	3	3

Nest survival for radio-marked birds in the Bi-State planning area was consistent between years with a slight increase from 35% in 2003 to 40% in 2004 (Table 4). We used Program Mark (White and Burnham 1999) to estimate nest survival, with the program taking into account the chance for birds to initiate a nest and have it fail before being detected. We used 23 nests for our 2003 analysis and 41 in 2004. We are continuing to examine the nesting and corresponding vegetation data to look for relationships that may exist between habitat condition and nest success.

Table 4. Nesting data for radio-marked sage grouse in 2003 and 2004.

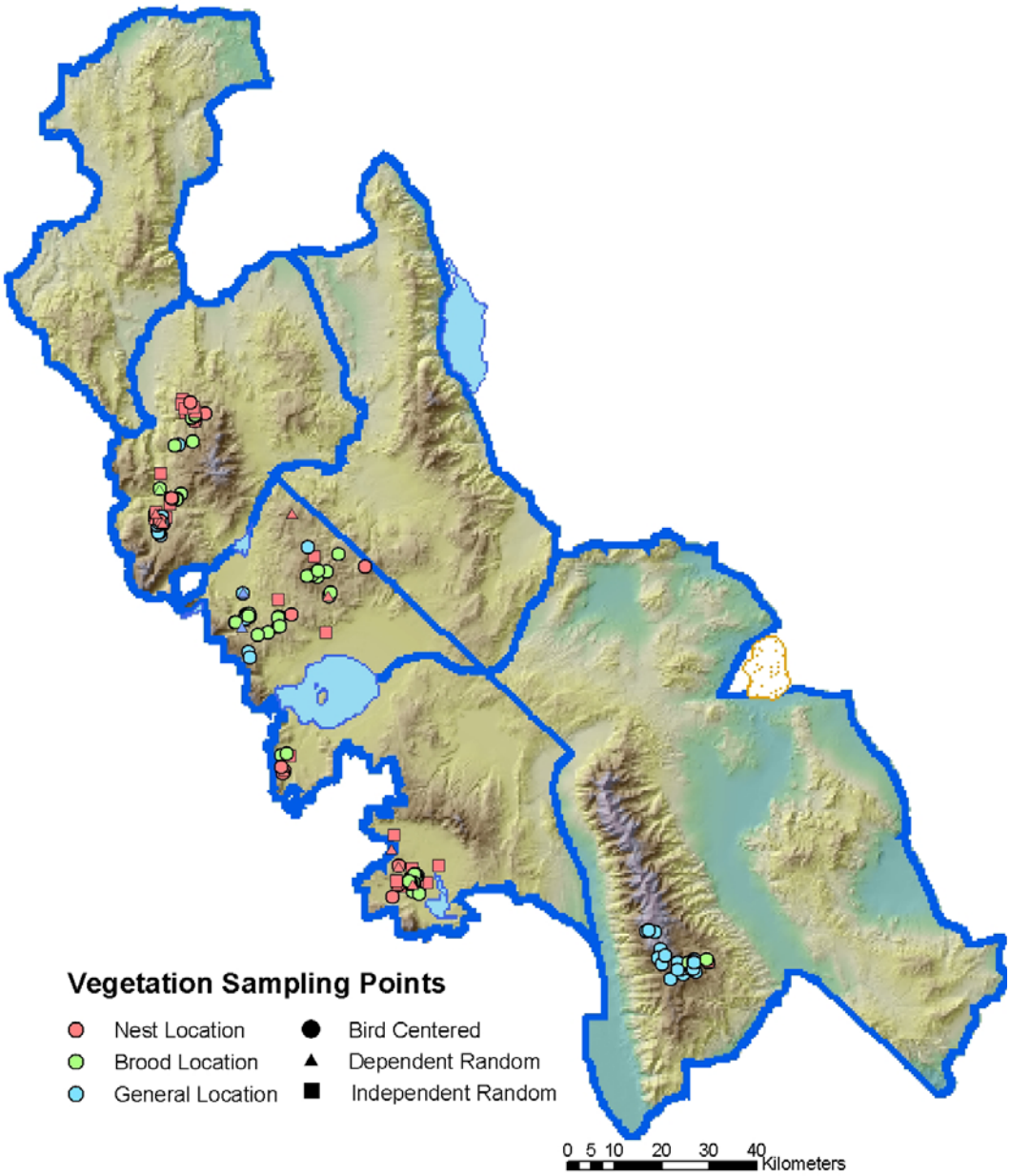
Season	Number of Initial Nests	Renests	# successful	# unsuccessful	Avg. Clutch Size	Nest Survival Rate
2003*	20	3	11	12	6.59	35%
2004	37	4	22	19	6.76	40%

*nine nests censored from analysis.

We measured vegetation characteristics at multiple sites throughout the study area. Detailed measurements include canopy cover, vegetation height, forb and grass

composition and cover, and visual obstruction (robel pole). Data was gathered at nest, brood rearing, and random locations throughout the study area (Figure 2).

Figure 2. Vegetation sampling conducted at 184 locations within the Bi-State Planning Area during 2003. Sampling completed at bird locations (circles) was paired with sampling done at random locations 50 to 200 meters away (triangles). We also sampled vegetation at random locations within the study area (squares).



Grouse nests (n=32) in 2003 had greater shrub cover and greater sage height than random locations within the study area (Table 5). Similarly, shrub cover and sage height

was generally greater at dependent random (points located 50-200m from the nest points) than independent random points (within the study area).

Table 5. Vegetation composition at nest sites and adjacent random locations in the Bi-State Planning Area.

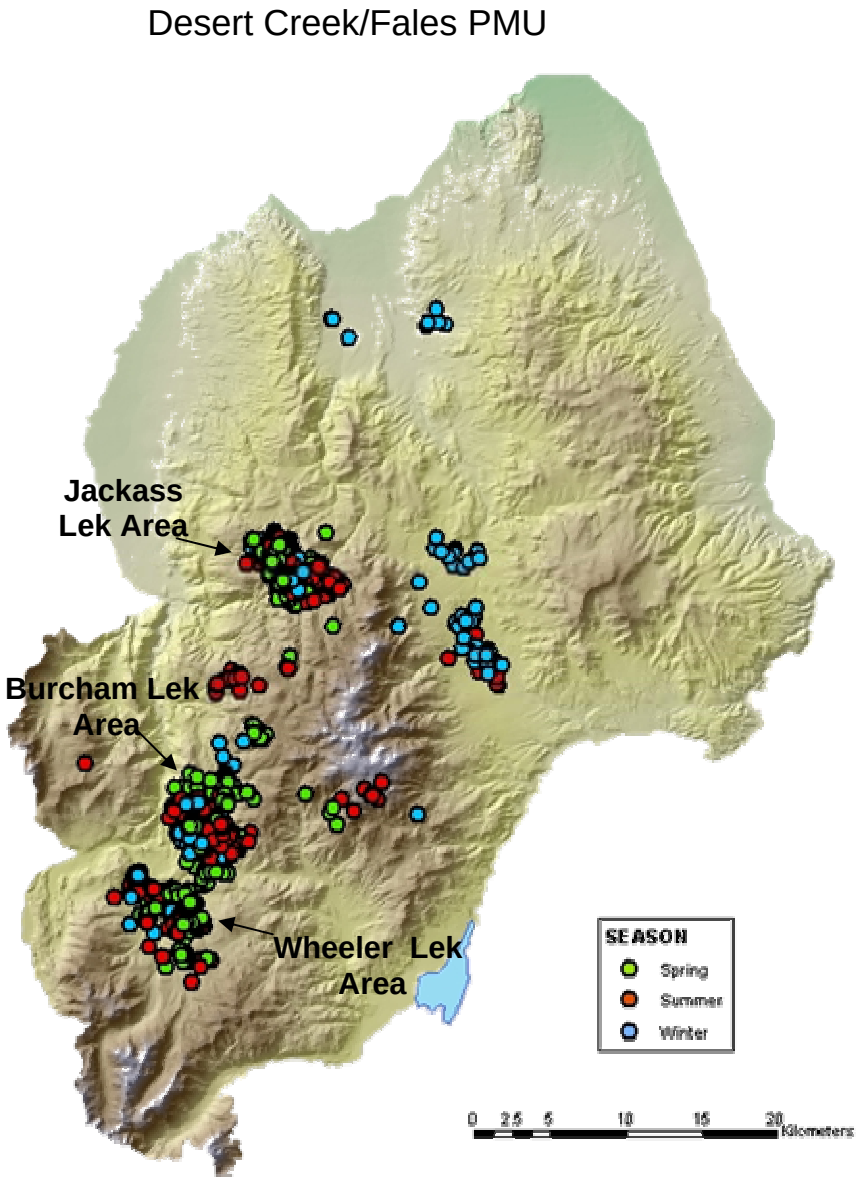
Study Area	Nests	DR Points	IR Points	Nest Shrub % Cover	DR Shrub % Cover	IR Shrub % Cover	Nest Sage height (cm)	DR Sage height	IR Sage height
BH	4	4	5	63.08	65.23	51.43	66.6	50.36	55.8
JA	8	8	7	45.89	36.66	32.56	41.1	35.24	30.0
LV	11	11	11	46.25	38.45	36.54	52.2	42.15	41.7
PA	2	2	1	49.50	47.60	30.60	54.7	44	43
FA	7	4	6	59.42	39.25	40.07	61.8	58.7	47.7
TOTAL	32	29	30	51.35	42.45	38.60	52.6	42.77	41.6

(BH = Bodie Hills, JA = Jackass Spring, LV = Long Valley, PA = Parker Meadows, FA = Fales Hotspring, DR – Dependent Random points located 50-200m from the nest, IR – Independent Random points located within the study area)

Desert Creek/Fales PMU

We radio-marked and tracked 40 individual sage grouse (12 males and 28 females) adjacent to leks at Burcham Flat, Wheeler Flat, and Jackass Spring within the Desert Creek/Fales population management unit. We obtained telemetry locations on radio-marked birds during all seasons (Figure 3).

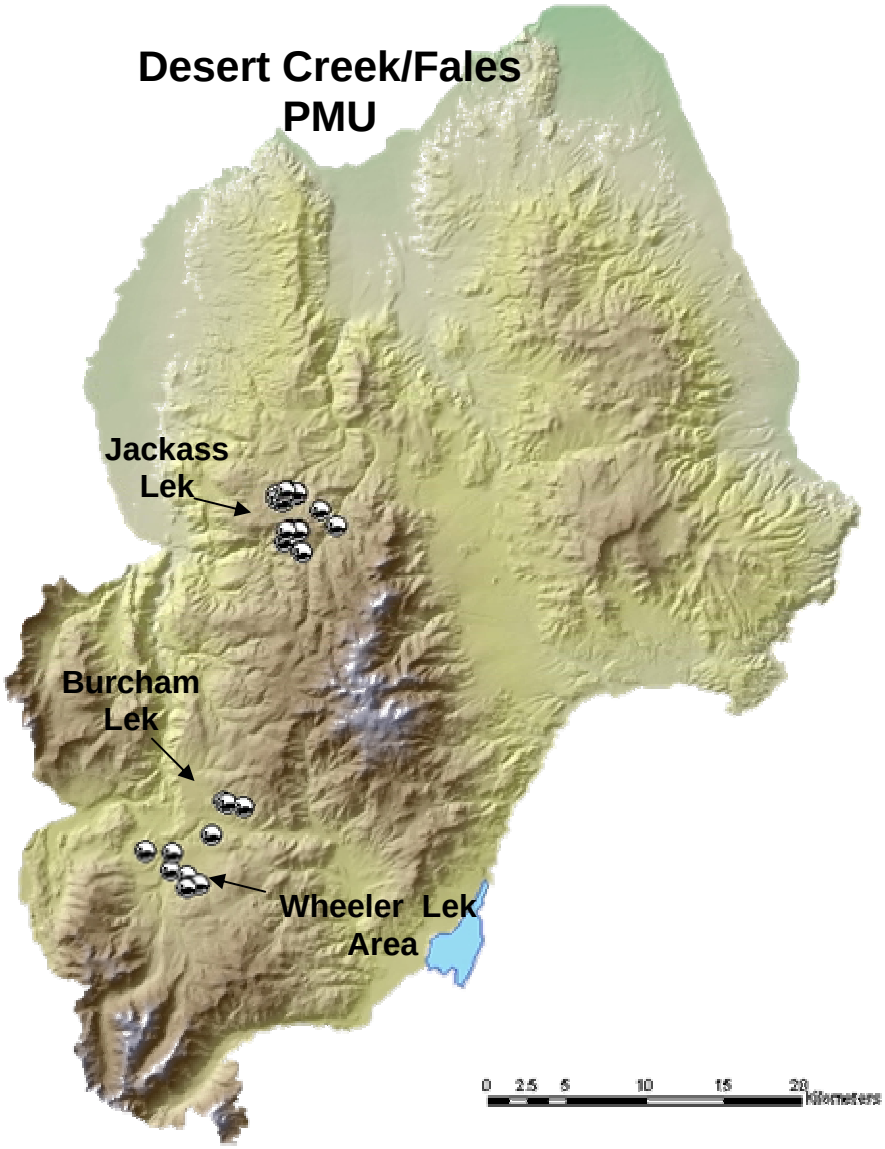
Figure 3. Radio-marked sage grouse locations in the Desert Creek/Fales PMU.



Many of the radio-marked birds spent winter, spring and summer in a fairly small area. Most of the birds marked near the Jackass lek remained in the area throughout the year or moved to the adjacent burn southeast of the lek during the spring and summer. The major exceptions to this were some of the Jackass Lek area birds that spent part of the summer and much of winter in the vicinity of the Sweetwater Ranch area and much of the winter near the Wiley Ditch leks. One of the birds spent a significant portion of the winter at the south end of Smith Valley as well. One female took her brood to the area north of Little Deep Creek during the late brood period. Most birds from the Fales area spent the spring and summer on the Wheeler Flat side of 395 or the slopes above Burcham Flat. Burcham Flat itself was used mostly during the winter. A few of the radio-marked male grouse moved to high elevation meadows near the top of the Sweetwater Mountains in the vicinity of Wheeler Peak, especially near Lobdell Lake.

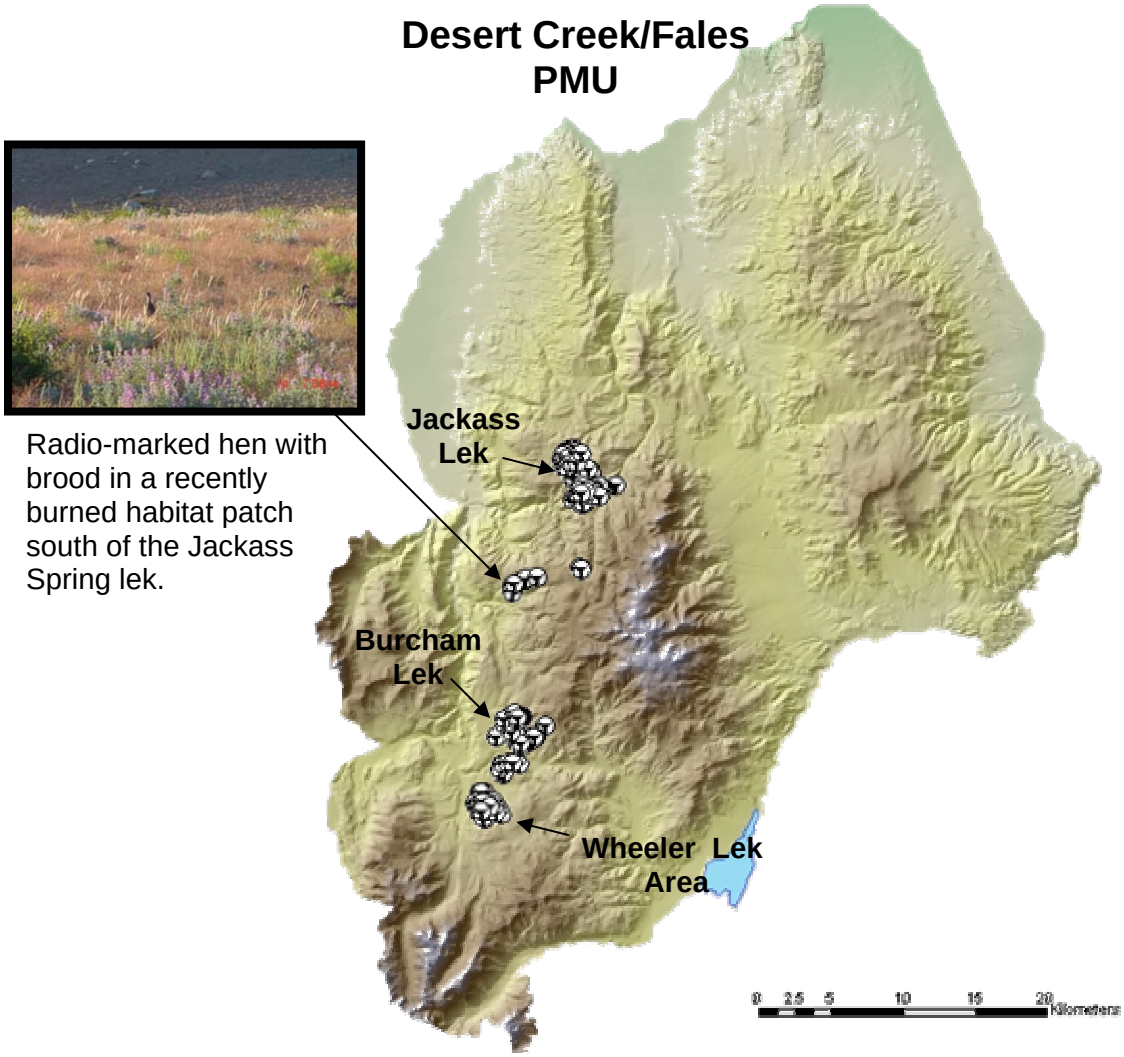
Most of the nest locations for radio-marked hens in the Desert Creek/Fales PMU were in fairly close proximity to the lek closest to their capture location (Figure 4).

Figure 4. Nest locations of radio-marked sage grouse in the Desert Creek/Fales PMU during the 2003 and 2004 nesting seasons.



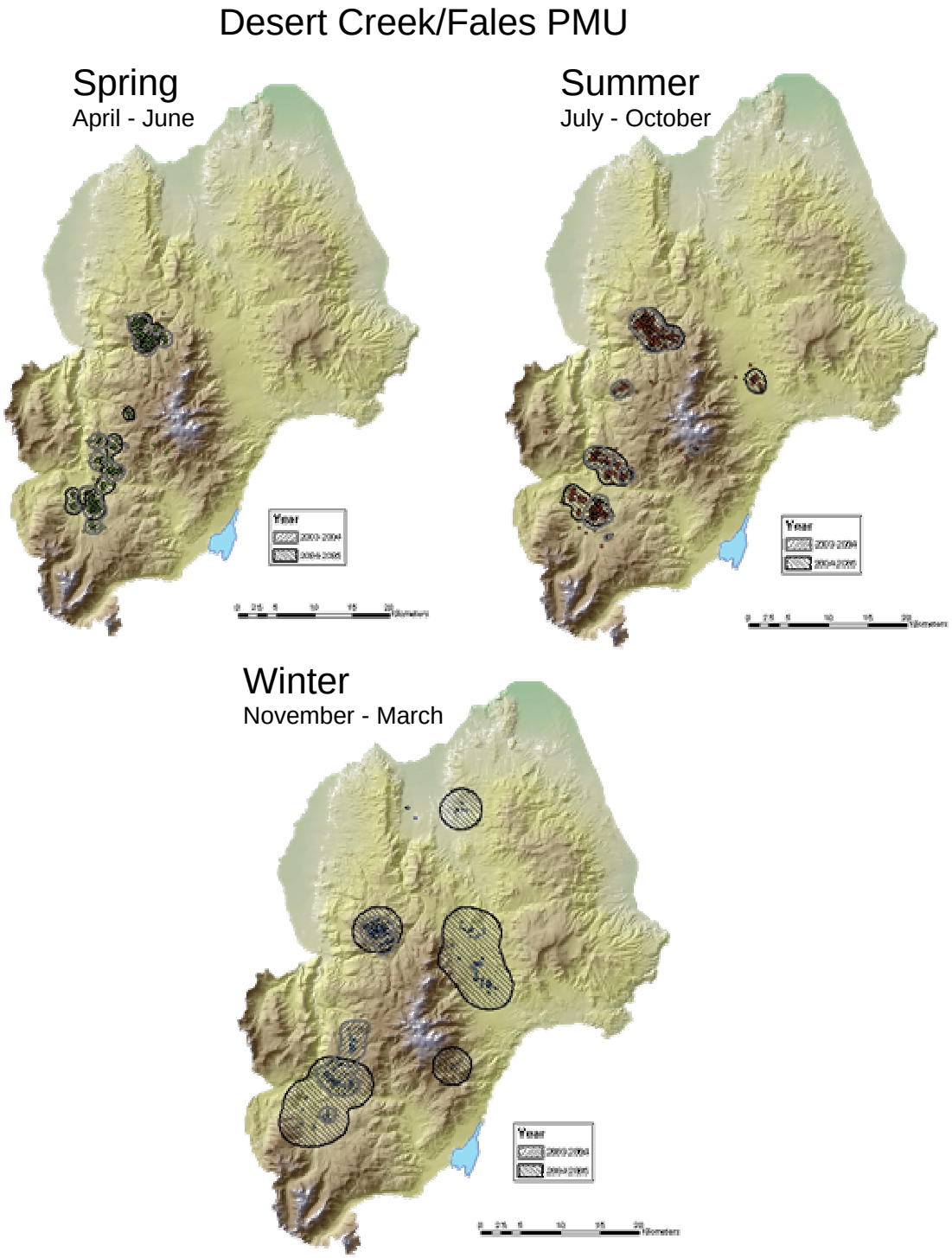
After hatching, radio-marked hens kept their broods fairly close to their respective nesting locations (Figure 5). The one exception to this was the aforementioned hen marked near the Jackass lek that moved her brood into the Little Deep Creek area that had recently burned and was several kilometers south of her nesting location (Figure 5).

Figure 5. Locations of radio-marked hens with broods in the Desert Creek/Fales PMU.



Seasonal use areas did not vary widely between years, however, there was a greater use of the lower elevation areas of Desert Creek and Smith Valley in the summer of 2004 and winter of 2004-05 (Figure 6). There was also increased use of the area west of Little Walker Creek near Wheeler Flat in 2004.

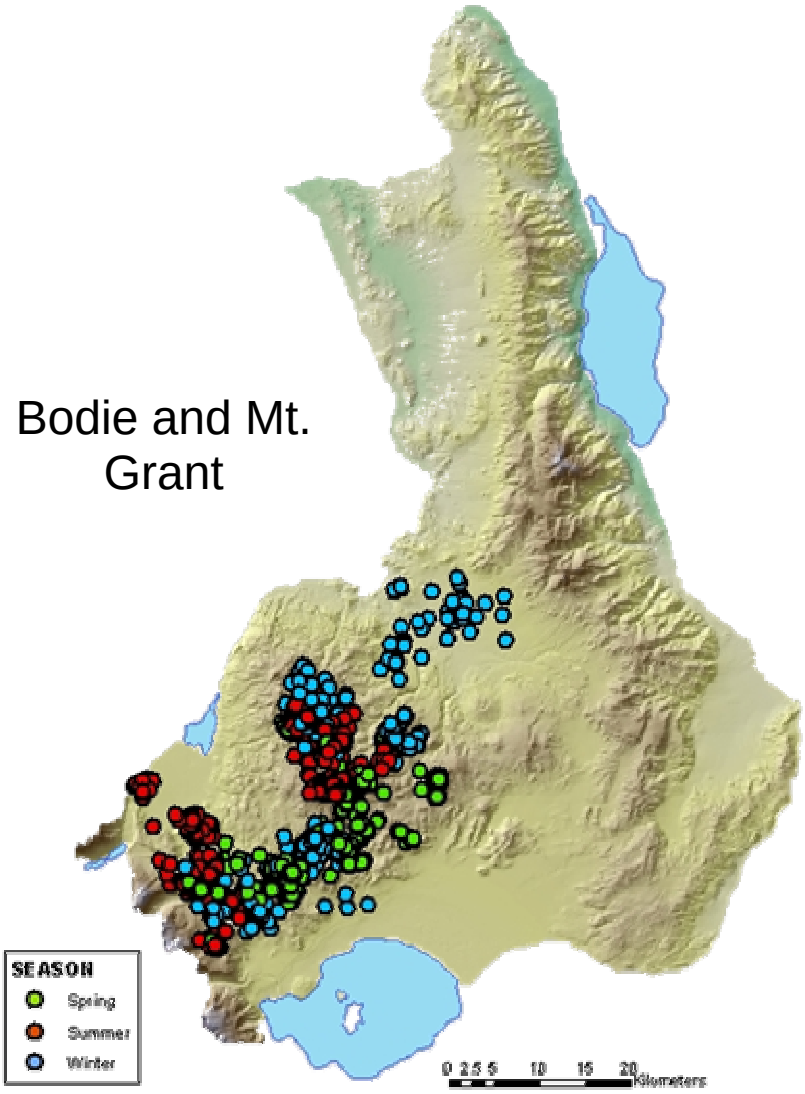
Figure 6. Seasonal use areas within the Desert Creek/Fales PMU (Spring = April-June; Summer = July-October; Winter = November-March).



Bodie PMU/Mt. Grant PMU

We radio-marked 35 sage grouse (9 males, 26 females) in the vicinity of several leks within the Bodie PMU. Some of these marked individuals were subsequently located within the Mt. Grant PMU and therefore data for both PMU's is presented here. Radio-marked grouse were located on an annual basis beginning in the spring of 2003 (Figure 7).

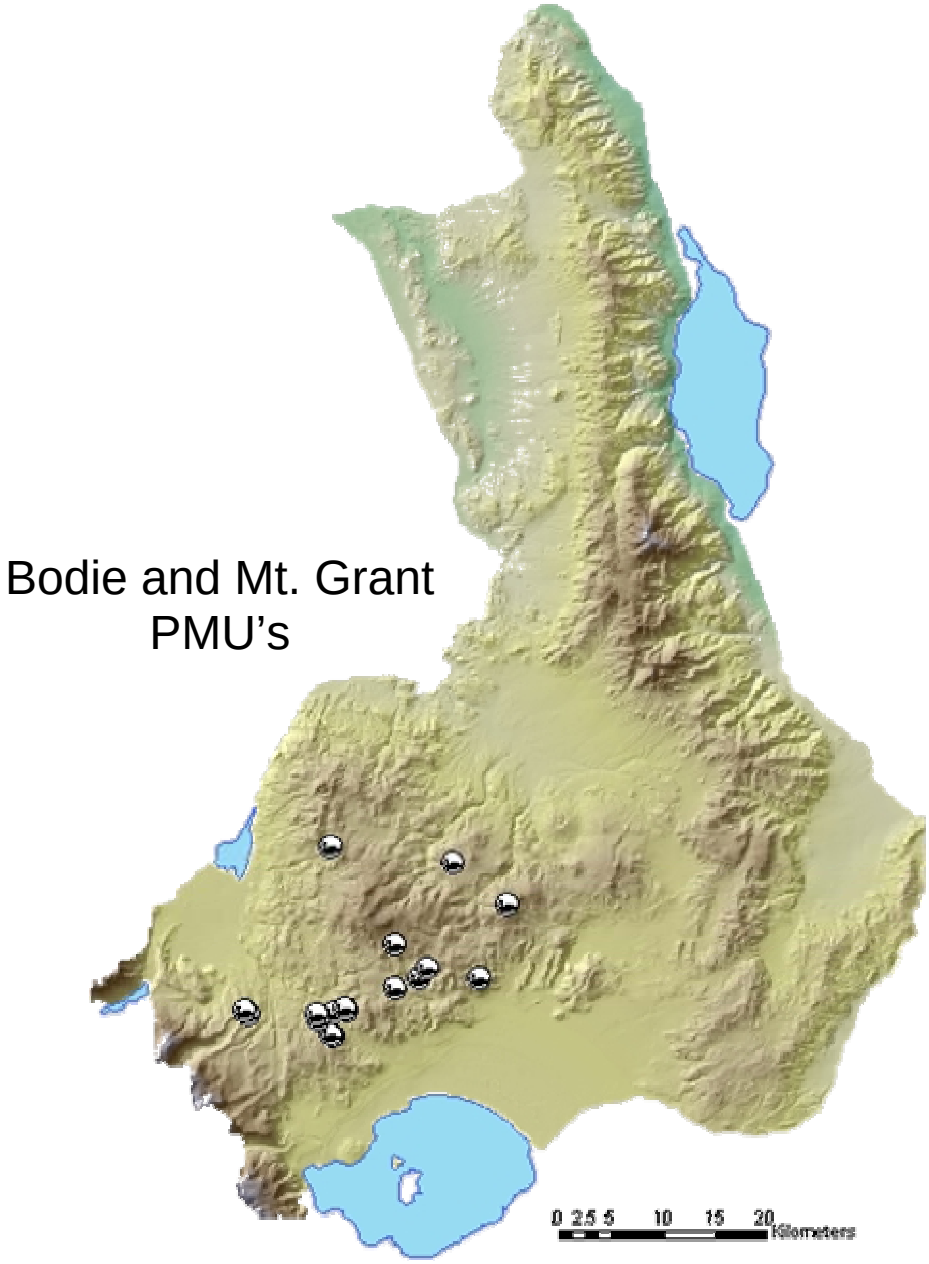
Figure 7. Radio-marked grouse locations in the Bodie and Mt. Grant PMU's.



The China Camp and Nine Mile Ranch areas within the Mt. Grant PMU were primarily used by Bodie marked birds during the winter period. In general, the marked grouse used the area between Mt. Biedermann and Bridgeport Canyon primarily during the winter and spring period. The north and east slopes of Bodie Mountain and the area around Paramount Mine were used especially during the spring and summer. The Big Flat area was used mostly in the summer and winter with some birds moving between Rock Springs and Aurora Canyons in the spring. Brawley Peak and the area southeast of Bodie State Park were used in the spring by nesting females. During the summer birds were often found using Bridgeport Valley and the surrounding ridges west of Highway 395. The area west of Highway 395 and north of Conway Summit was used during all seasons, as was the Dry Lakes area near Beauty Peak.

Nests were distributed throughout the Bodie PMU with concentrations around Bridgeport Canyon and Bodie State Park (Figure 8). Many of the nests were in fairly close proximity to the hens' capture site (when captured in the spring). The vegetation structure associated with nests in the Bodie PMU had a higher canopy closure and than in other PMU's.

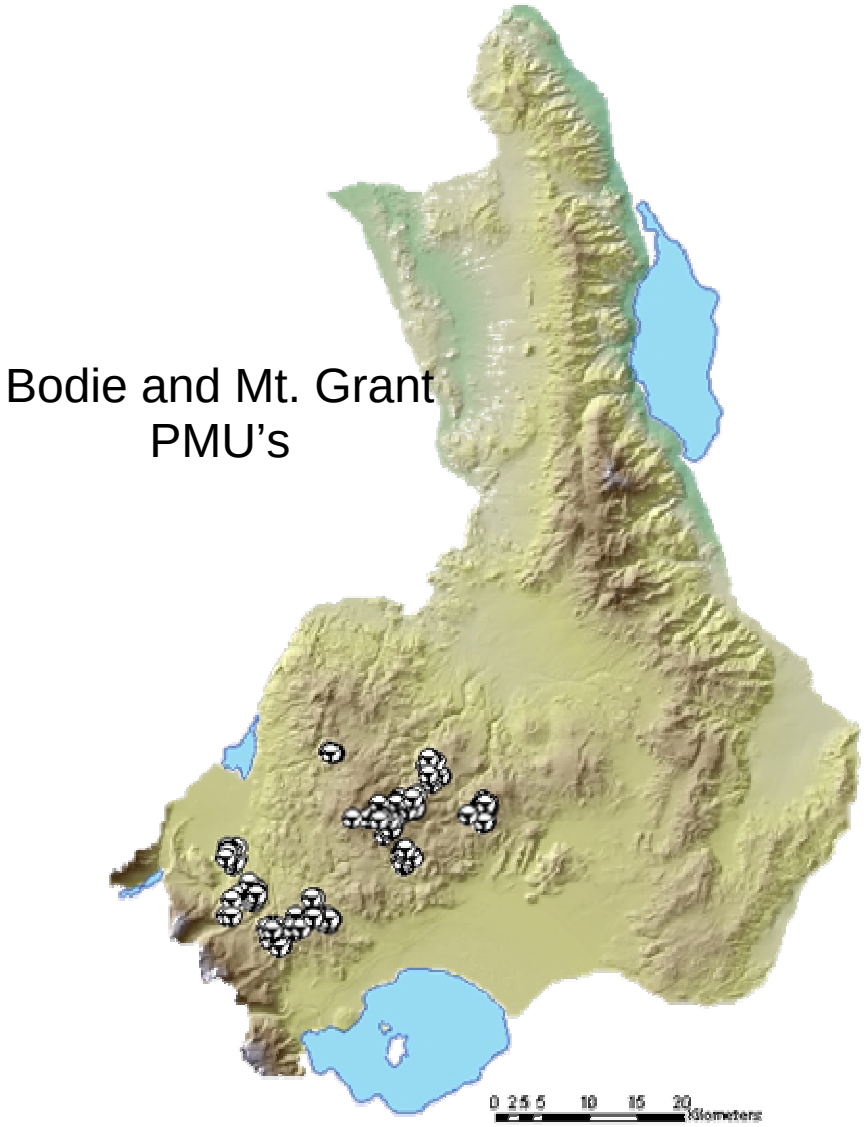
Figure 8. Nest locations of radio-marked grouse in the Bodie PMU during the 2003 and 2004 nesting seasons.



Brood locations were also distributed throughout the PMU (Figure 9). The hills to the south of Bridgeport Valley and the valley itself were used by hens with broods as was the area from Conway Summit to Bridgeport Canyon. The area near Bodie State

Park and between Bodie Mountain and the Dry Lakes area was also used by broods. In 2003 hens with broods were also found at Brawley Peak and between Rock Springs and Aurora Canyons.

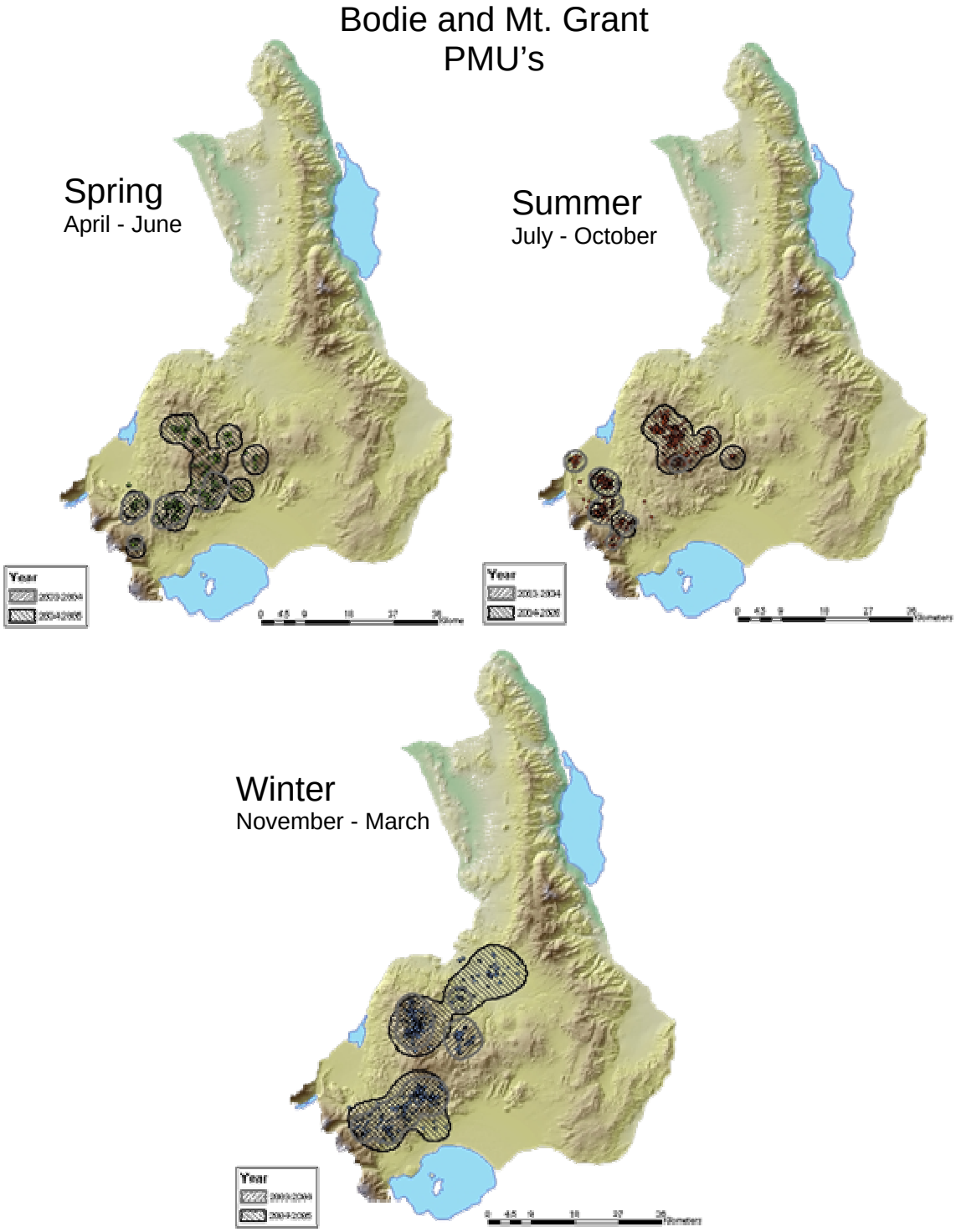
Figure 9. Locations of radio-marked hens with broods in the Bodie PMU.



Brood locations were concentrated in the area of Conway summit and the southern end of Bridgeport Valley as well as the area to the west and north of Mt. Biedeman.

Seasonal use areas were fairly similar between years (Figure 10). Mt. Grant PMU received use in both winters of 2003-04 and 2004-05, but use was more prevalent in 2004-05 while use of the Dry Lakes area was less prevalent. Summer use of the Bridgeport Valley appears greater in 2003 than 2004 but may have been influenced by the distribution of radio-marked male grouse during those seasons. The increased spring and summer use of the northeastern portion of the Bodie PMU (e.g. Dry Lakes, Big Flat) during 2004 was due to increased trapping effort in these areas during the fall of 2003.

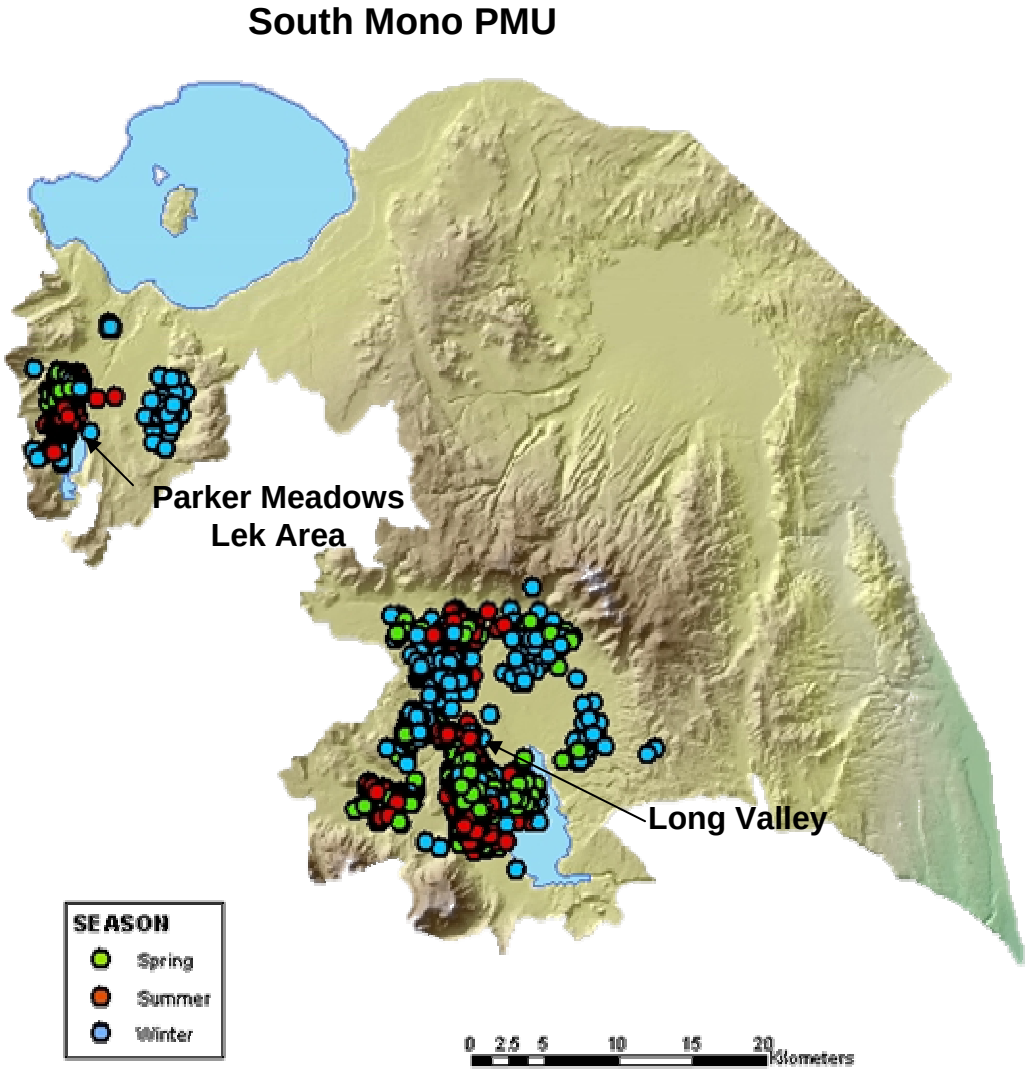
Figure 10. Seasonal use areas within the Bodie/Mt. Grant PMU's (Spring = April-June; Summer = July-October; Winter = November-March).



South Mono PMU

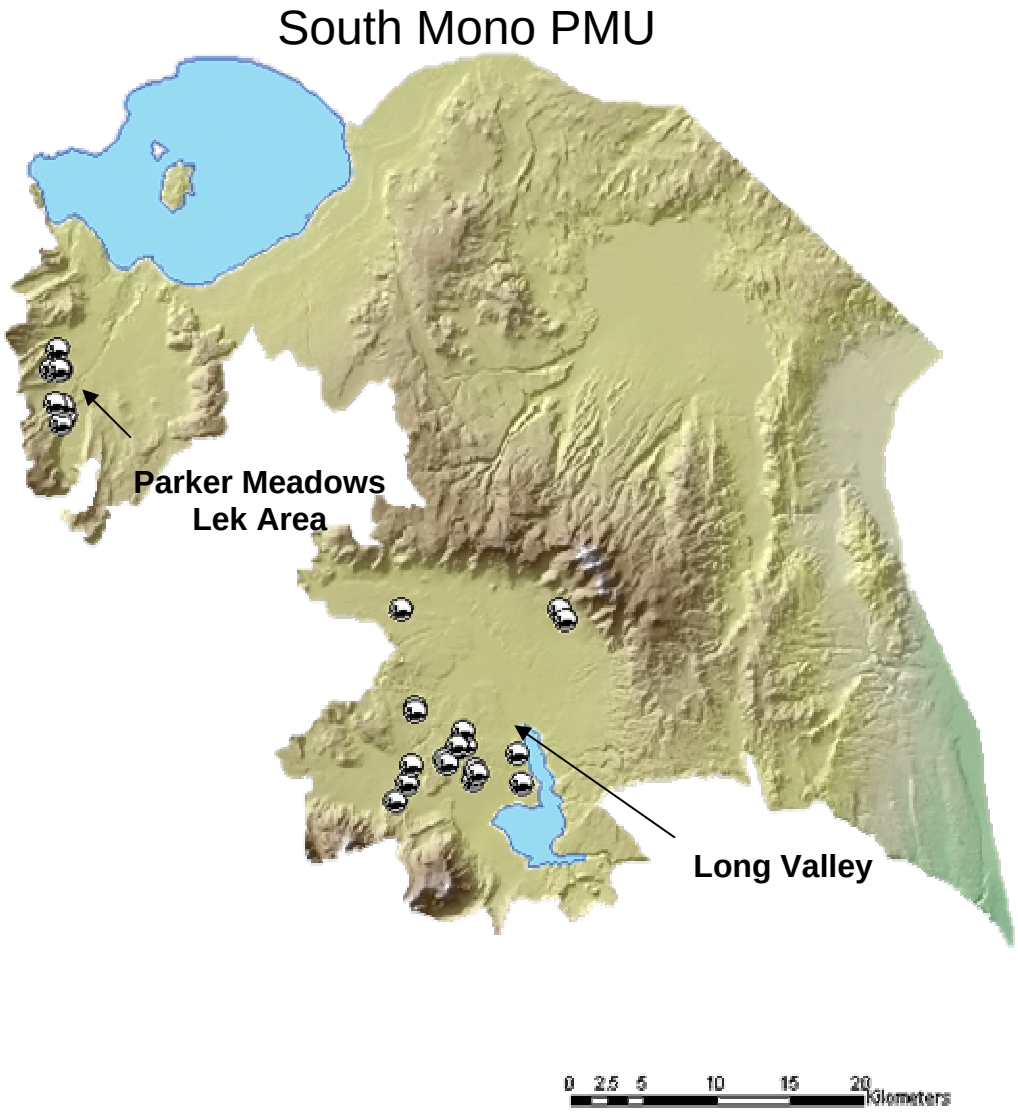
We monitored radio-marked birds in the South Mono PMU beginning in the spring of 2003 (Figure 11). Birds were marked in two areas including the Parker

Figure 11. Radio-marked sage grouse locations within the South Mono PMU.



Meadows area just south of Mono Lake, and the Long Valley area near Crowley Lake. Grouse locations were recorded for 9 females and 3 males marked in the Parker area and 16 females and 9 males marked in Long Valley. Radio-marked hens were found nesting in a variety locations throughout the PMU (Figure 12). Hens in the

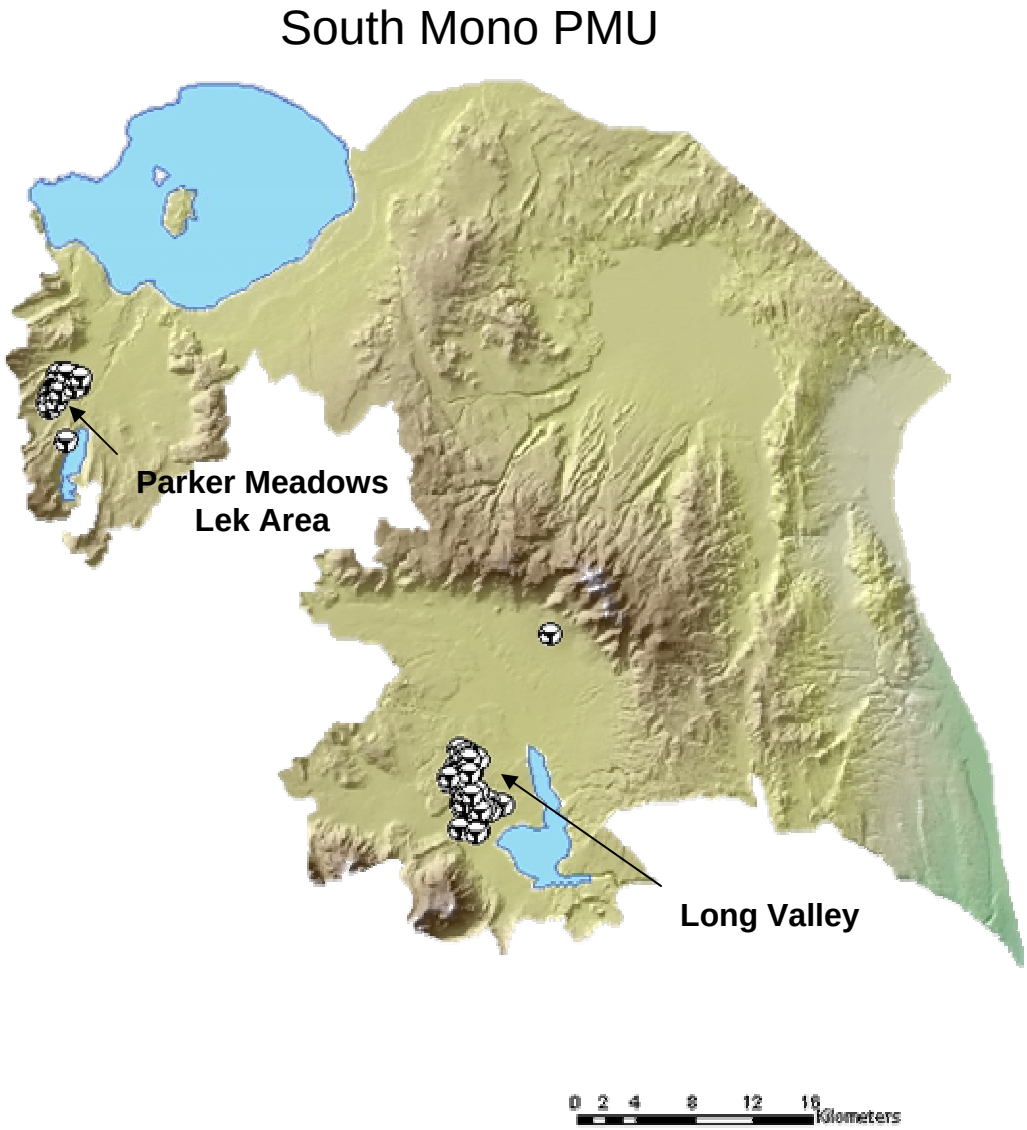
Figure 12. Nest locations of radio-marked grouse in the South Mono PMU during the 2003 and 2004 nesting seasons.



Parker area nested on the ridges directly west of the meadow area while nests in the Long Valley area were concentrated around the Whitmore Tubs area with a few hens nesting in more unique areas such as the base of the Glass Mountains and near the Mammoth Airport. Hens with broods in the Parker area could be found using the meadow and

ridgelines to the west of the meadow (Figure 13). Long Valley hens with broods were heavily concentrated in the vicinity of Whitmore Tubs and lek 2.

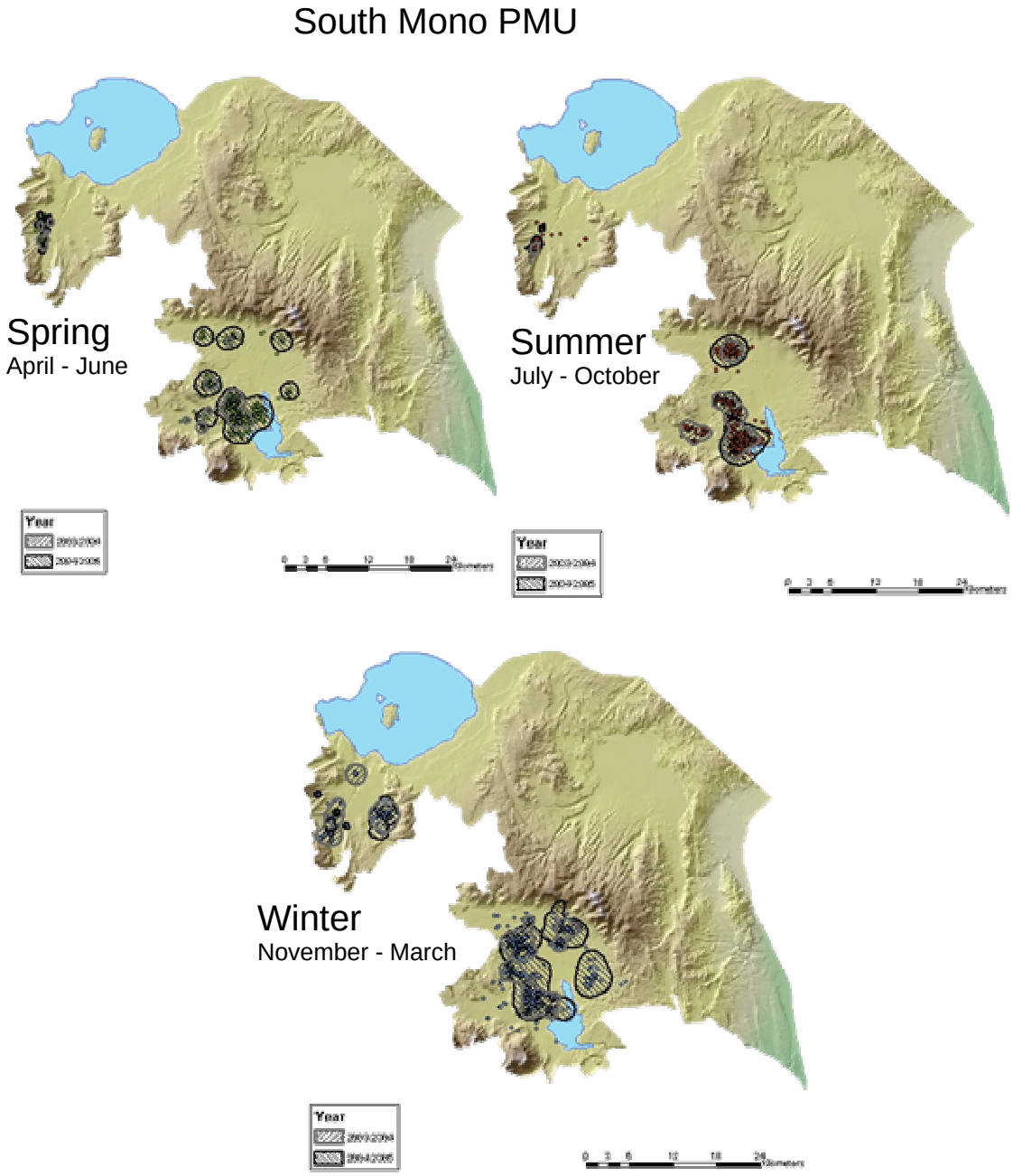
Figure 13. Locations of radio-marked hens with broods within the South Mono PMU.



Seasonal habitat use was very distinctive in the South Mono PMU (Figure 14). Almost all sage grouse locations in the Parker area during the winter were east of highway 395 at the base of the Mono Craters. Spring and summer points were primarily in the Parker Meadow area and on the ridges above the meadow and near Grant Lake. In

Long Valley there were also well defined winter use areas, although somewhat different between years. In 2003-04 the birds were concentrated in the winter in the Little Hot Creek Bench area while in the heavier snow year of 2004-05 the birds were found in the East Valley/Waterson Troughs area in high numbers. Biologists reported over 1000 birds utilizing this area between January and March, 2005(USGS unpublished data). Other important areas used in winter include the O'harrel Canyon and Glass Mountain area and the area between Hot Creek and Little Hot Creek. The Owens River/Hot Creek and Convict Creek meadows were important use areas during both years during the summer months. Spring use of the North Landing area and the Whitmore Tubs area was fairly consistent between years.

Figure 14. Seasonal use areas within the South Mono PMU (Spring = April-June; Summer = July-October; Winter = November-March).



White Mountains PMU

We radio-marked and tracked 24 individual sage grouse (7 males and 17 females) at Red Peak, Sage Hen Peak and the Cottonwood Creek drainage within the California portion of the White Mountains population management unit. We obtained ground telemetry locations on radio-marked birds from mid spring through summer (Figure 15). Winter and early spring locations were obtained using aerial telemetry.

Birds utilized the Reds Peak and Bucks Peak Flat area throughout the year. Additional wintering areas were identified in 2004-2005 in Tres Plumas and at the Headwaters of Mill Canyon. The south slope of the North Crooked Creek Drainage and County Line Hill were used during both spring and summer as was Sheep and Campito Mountains. Sage Hen Peak was used mostly during the spring. Sage Hen Flat and the area between Mount Barcroft and Piute Mountain were used during the summer.

Many grouse had already begun nesting by the time the study area was accessible in the spring of 2004. We located only one nest in 2004 and increased our radio-marked sample in the fall of 2004 to help address this small sample. The nest was located near Sage Hen Flat, just below Station Peak (Figure 16). Sage Hen Flat is the location of a lek newly discovered in 2004.

Figure 15. Radio-marked sage grouse locations within the White Mountains PMU.

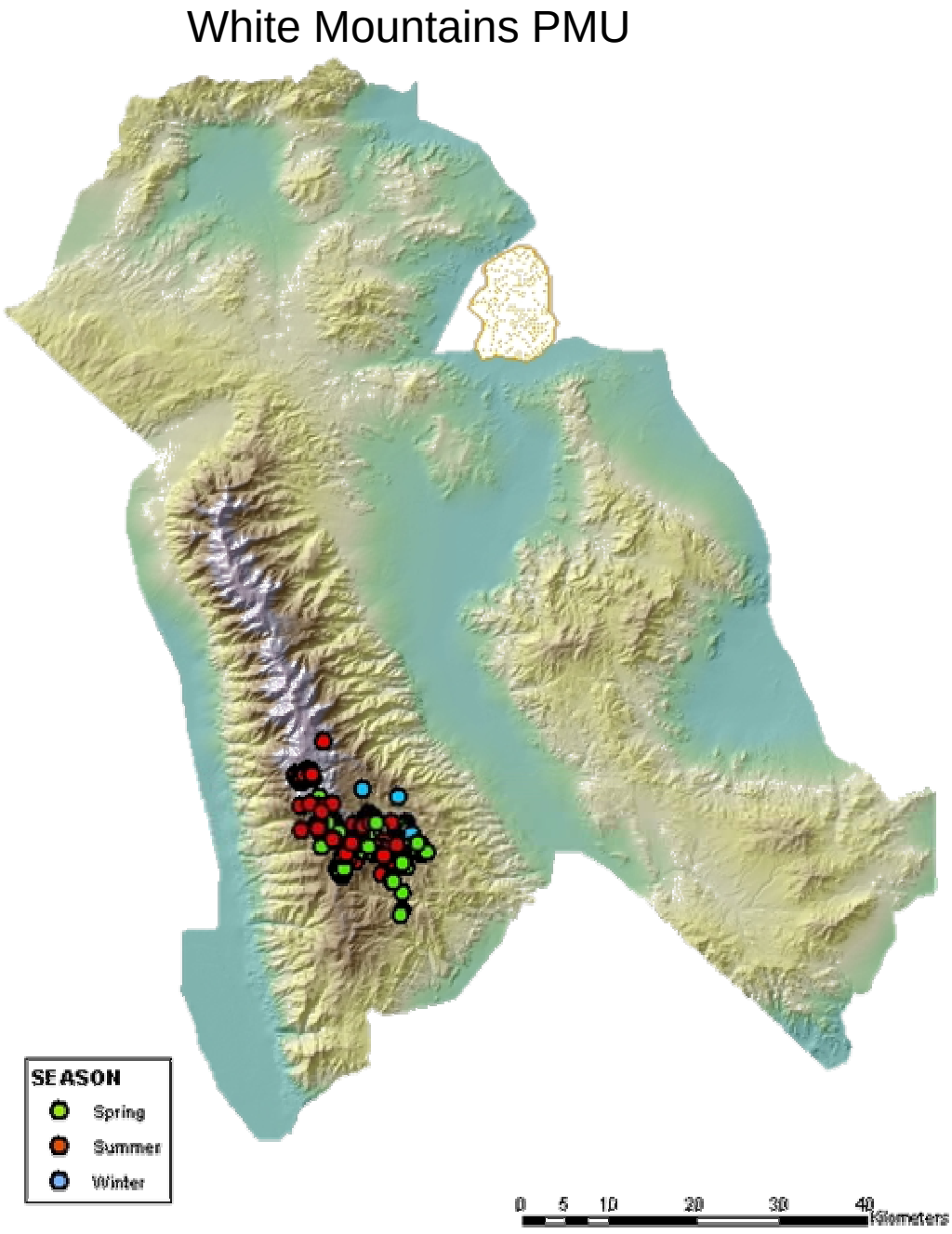
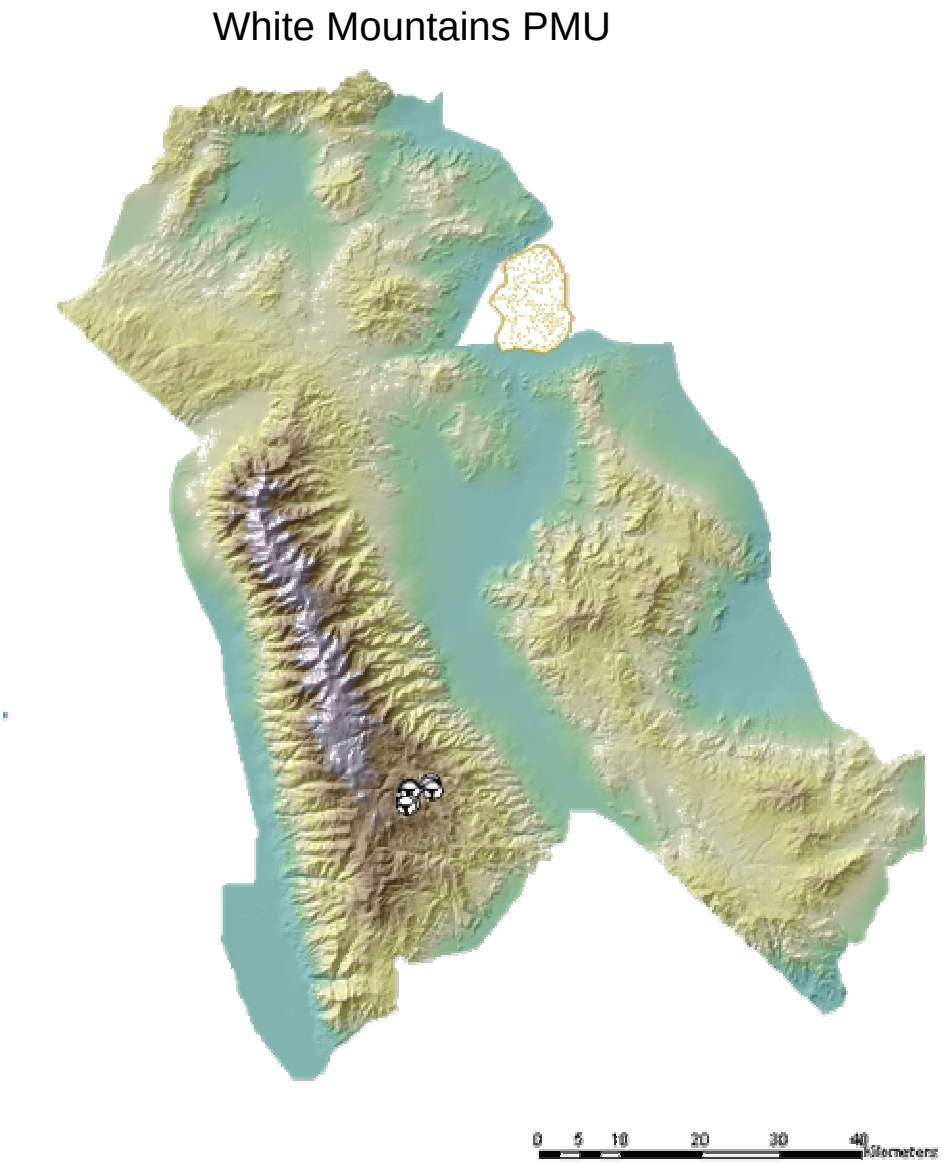


Figure 16. Nest location of radio-marked grouse in the White Mountains PMU during 2004 nesting season.

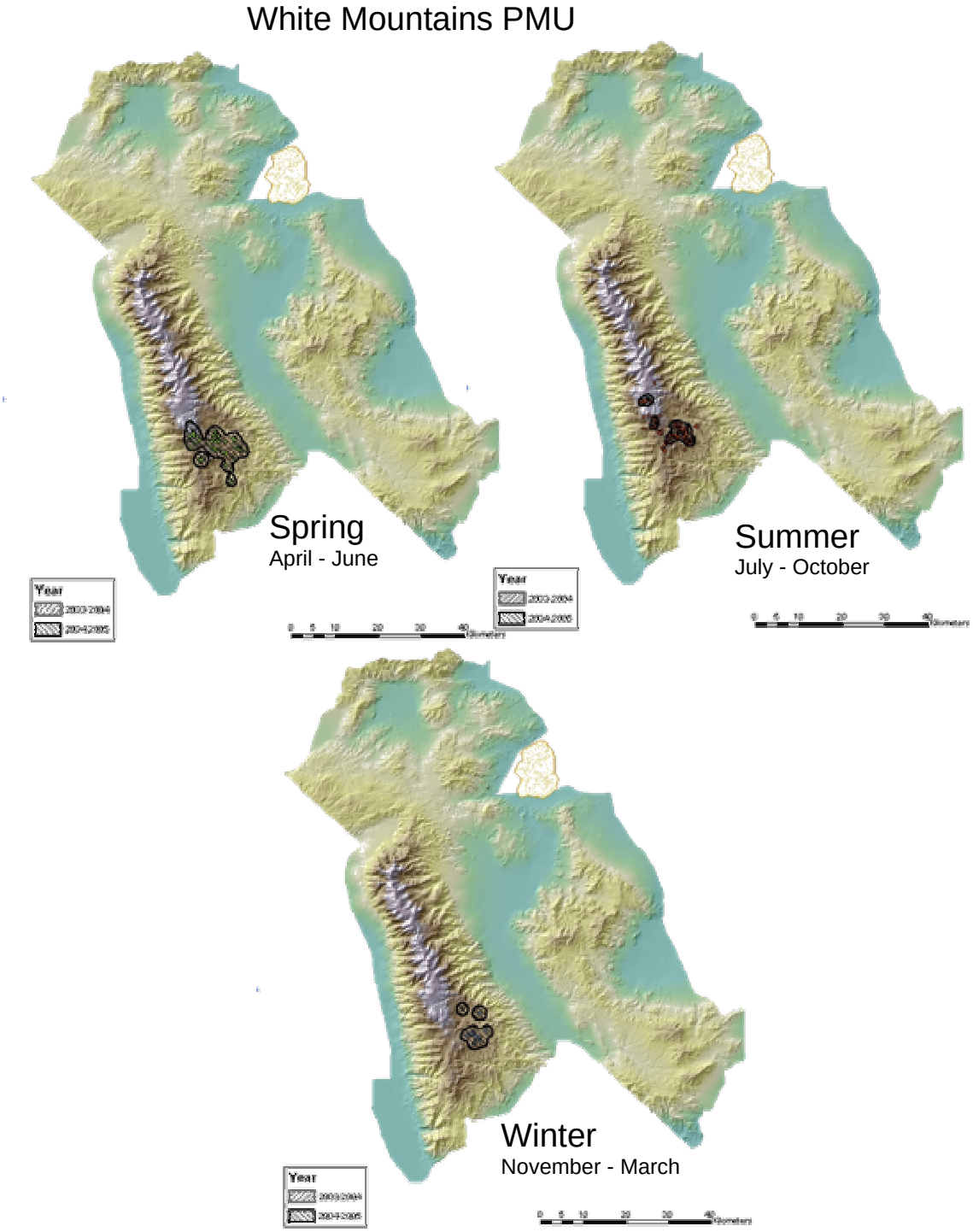
Brood rearing areas identified in 2004 were located from a single hen (Figure 17). The brood was first taken upslope to Station Peak for nearly a month. Then the hen took the brood about 2 km to the Crooked Creek drainages north of Bucks Peak. The brood remained in this area through the summer.

Figure 17. Locations of radio-marked hens with broods within the White Mountains PMU.



Comparisons of seasonal use areas between years will be available after another field season once additional telemetry can be obtained (Figure 18). During 2004, there was substantial overlap among seasons, with some expansion into higher elevations in the summer. Aerial telemetry has shown connectivity between disconnected habitat patches (i.e. Tres Plumas Flat) and concentration in localized areas.

Figure 18. Seasonal use areas within the White Mountains PMU (Spring = April-June; Summer = July-October; Winter = November-March).



2005 Field Work/Data Analysis

Planned field work for 2005 includes monitoring radio-marked grouse primarily during the nesting season in the Bodie, South Mono and White Mountains PMUs through the spring, summer and early fall. We will continue to monitor radio-marked birds in the Desert Creek/Fales PMU on a weekly to bi-weekly basis. Focus areas will include nesting and brood success in the South Mono and Bodie PMU's while we will continue to collect seasonal use and movement data along with nesting data in the White Mountains.

Radio-tracking will continue into the early fall in order to monitor for any indication of West Nile Virus affecting sage grouse in this region, although sample size and tracking frequency will be limited due to funding constraints. In addition to the radio-tracking we will also continue to gather vegetation information, primarily from nesting and brood locations of radio-marked grouse, but also from winter (2004-05) bird use areas. This data will be used to characterize suitable nesting, brood rearing and winter habitats within the Bi-State region.

Data analysis will continue through the spring and summer, integrating new information as it is collected. Vegetation data from 2004 will be incorporated into the database and analyzed with respect to nest and brood success data. Results from our data collection and analysis will be provided to the Bi-State group for inclusion in subsequent revisions of the Bi-State Sage Grouse Conservation Plan. A final report from this work is planned for the spring of 2006.

Acknowledgements

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Literature Cited

Bi-State Local Planning Group. 2004. Greater Sate-Grouse Conservation Plan for the Bi-State Plan Area of Nevada and Eastern California – First Edition.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

White, G.C. and K. P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46 Supplement, 120-138.

Wyoming Field Office, US Fish and Wildlife Service 2005. Endangered and Threatened Wildlife and Plants; 12 Month finding for petitions to list the greater sage-grouse as threatened or endangered. Federal Register 70(8):2244-2282.