

# Fire and Invasive Plants in

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The appropriate and effective management of fire and invasive plants have become important issues for land managers during recent decades in California and the rest of the United States. Reintroduction of fire for ecosystem benefits and recent fuel loads are now relatively commonplace in mesic grasslands, shrublands, and woodlands. Control of invasive plants involves cooperative efforts among public and private land managers at national and local scales. However, for all of the effort expended individually on these two worthy endeavors, very rarely have the interrelationships between fire and invasive plants been considered. In this article I summarize some of the key points.

## Interrelationships between fire and invasive plants

Fire can promote the dominance of a wide variety of invasive plants in many different wildland habitats. Invasive plants that respond positively to fire include perennial grasses such as giant reed, fountain grass, and perennial rye; annual grasses such as red brome, cheatgrass, medusahead, and Mediterranean split grass; forbs such as mustards and thistles; succulents such as highway iceplant; and woody plants such as tamarisk, brooms, and gorse. Examples of habitats affected include desert shrublands and shrub-steppe, coastal and interior chaparral and coastal sage scrub, and mixed coniferous forests.

Although fire may not be necessary for invasive plants to become established, it is often an important factor allowing them to become dominant ecosystem components. Increased availability of light and soil nutrients in the postfire landscape seem to favor ruderal species, which can rapidly disperse into burned areas and efficiently convert resources into standing biomass and new propagules. Dense swards of invasive plants can hinder the postfire recovery of native species by competing with them for limiting resources. Some native plant communities can eventually regain dominance, and in the case of mature chaparral suppress germination and growth of invasive annual plants by shading the soil. Unfortunately, invasive annual plants such as mustards can remain dormant in the seedbank for decades, waiting for the next fire or other disturbance event to open up the shrub canopy and allow them to grow and reproduce.

Invasive plants can change fire regimes in ways that promote their own dominance, and in the process type-convert native plant communities into invasive alien communities. Densely packed invasive grasses are notorious for increasing landscape flammability, which promotes fire return intervals that are often much shorter than native plants can survive. The ability of native plants to recover diminishes with each successive fire, whereas the fires keep coming back for more. This grass-fire cycle has converted native plant communities into invasive annual grasslands that appear to persist indefinitely. Vegetation type-conversions caused by altered fire regimes may have dramatic effects on organisms ranging from soil flora and fauna to macro-vertebrates. Sometimes the effects are indirect, as they cascade up through multiple trophic levels. One example is the conversion of Great Basin sagebrush to invasive annual grassland, which reduced available habitat leading to reduced numbers of black-tailed jackrabbits, and reduced the prey base and was associated with declines in golden eagle densities. Very few examples of this sort have been described, but it seems highly probable that altered fire regimes caused by invasive plants have many complex effects on a wide variety of organisms.



Photo by: Matt Brooks

## Fire Management Activities and Plant Invasions

Fire management activities can facilitate plant invasions, which may inadvertently cause future fire management problems. Prefire suppression, active fire suppression, and postfire rehabilitation can all promote invasions in various ways. Although these

# the Wildands of California

activities are necessary and integral parts of fire management programs, there are some ways their negative effects can be minimized.

Fire breaks create gaps in otherwise continuous native shrub cover can allow invasive plants to spread from local areas of infestation into new areas. The invasion potential along fire breaks is compounded by the arrival of invasive plant propagules on equipment used to construct the breaks and vehicles that subsequently use the breaks as routes of travel. Invasive plant spread along fire breaks can be minimized by not constructing them through known concentrations of invasive plants and by washing vehicle tires before they leave these areas.

Emergency watershed rehabilitation activities after fires can also promote the dispersal of invasive species into postfire landscapes. Steep slopes are often stabilized using mulch or seeding, both of which may contain invasive plant propagules. The potential for introducing undesirable invasive plants can be minimized by using certified weed-free hay as mulch and seeds of native plants or short-lived alien plants such as cereal grains that have a low potential for becoming invasive. Postfire rehabilitation sites should be monitored annually to detect and eradicate nascent populations of invasive plants.

## Control of Invasive Plants Using Fire

Ironically, fire may be one of the most useful tools available for controlling invasive plants. Weed flaming has been used in croplands, and involves killing invasive plants with ignited liquid fuels ejected from sprayers. Prescribed fire is more commonly used in wildland areas, and uses the litter or standing dead plants as fuel. As with most invasive plant control methods, single applications are insufficient, and follow-up treatments with additional burning or herbicide applications are necessary.

Not all invasive plant can be controlled using fire. Those most susceptible have perennating structures that are exposed

and vulnerable to fire during some phase of their development. Populations of invasive annual plants can be reduced if fire is applied while seeds are suspended above-ground in their inflorescences. Fire temperatures are much higher above than at or below the soil surface. Immature seeds have lower lethal temperatures than fully cured seeds due to their higher moisture content. Annual plants with short-lived seed banks are most amenable to management with fire, because successive treatments over only a few years can deplete most of the population.

Revegetation using native plants, or less invasive alien species, is generally required as a final step in any invasive plant control program. Using plants of low flammability can have the added benefit of increasing the interval between fires which may be the single best way to manage fire prone invasive species.

## An Integrated Approach Is Needed

Clearly there are many reasons why the management of fire and invasive plants must be integrated, and I have only briefly touched upon them in this article. Managers are partly limited by a lack of basic research on the interrelationships between fire and invasive plants, and programs such as the Joint Fire Sciences Program ([www.nifc.gov/joint\\_fire\\_sci](http://www.nifc.gov/joint_fire_sci)) are providing important resources to help fill this void. However, plans for managing fire and invasives are still mostly developed separately in most land management agencies, resulting in sometimes conflicting goals. Integration must begin at the planning stages and end with coordinated implementation in the field for effective management of fire and invasive plants. ❖

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After fire, a solid non-native grassland

Photo by: Matt Brooks