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Invasive Plants and Wildfires in Southern California

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Introduction

Wildfires are a regular and natural occurrence in most of southern California. The most common native vegetation types, including chaparral, coastal sage scrub, and valley grasslands, occur from near the coast to elevations of 3,000 feet (900 m) and are well adapted to fires. These ecosystems will return to their natural state within a few years of a fire under normal conditions. Conifer forests and oak woodlands can tolerate low intensity fires that burn through the undergrowth, but are severely damaged by intense fires like those occurring in southern California in 2003. Riparian (river and creek) vegetation often re-sprout vigorously following fire, possibly as an adaptation to historical fires that occurred during drought years or due to frequent flooding events that usually top-kill plants (see fig. 1). Of all native ecosystems in southern California, deserts have the least history of wildfires because of the sparse and discontinuous vegetation. As such, the native species in this habitat are the least adapted to fire (see fig. 2).

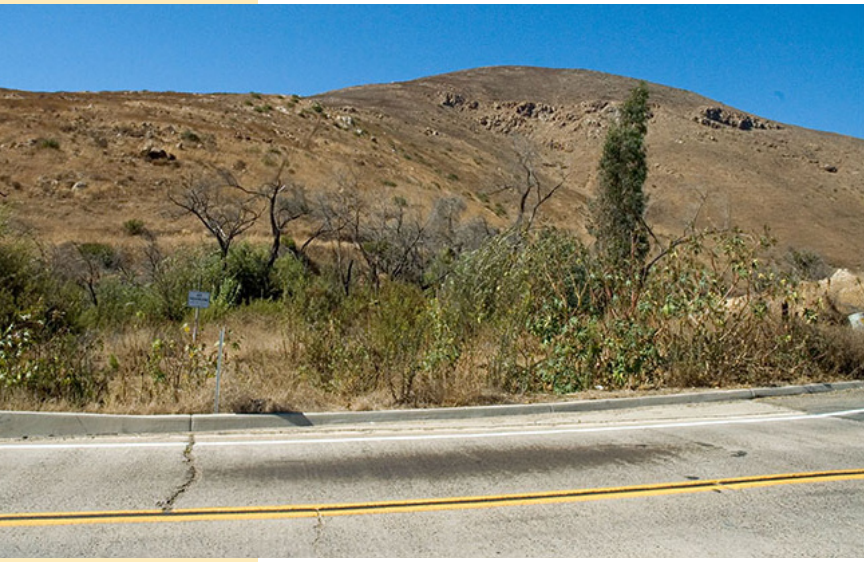

Figure 1. *Post-fire creek in San Diego County. Willow trees are recovering from the base, but the invasive eucalyptus on the right is resprouting along the trunk. Photo: Carl E. Bell*

Figure 2. *A fire the previous year fueled by non-native grasses burned through this stand of Joshua trees, leaving scarred trunks. The Joshua trees eventually died. This area may take 50 to 100 years to fully recover assuming that there are no additional fire events. Photo: Carl E. Bell*

Figure 3. *This photo was taken in December 2003, two months after the Otay fire in San Diego County. The green areas are non-native grasses, the first plants to emerge from the first winter rain. Photo: Carl E. Bell.*

Figure 4. *The same site as Figure 3, taken in March 2005, 16 months later. The heavy growth of non-native weedy annual grasses is slowing the recovery of the sycamore tree and the native shrubs on this slope. Photo: Carl E. Bell.*

In all of these areas or habitats, the presence of weedy non-native invasive plants creates an abnormal situation that can influence wildfires. Invasive plants often increase the frequency of fires by providing more-continuous fuels that are easier to ignite. After fires, these weedy invaders typically reestablish more rapidly than native plants, suppressing the recovery of the natives and allowing the weeds to expand their range (figs. 3, 4, and 5).

In addition, if fires occur too frequently, some of the native vegetation can become so severely damaged that it can no longer recover. This effectively converts high-diversity native plant communities into low-diversity non-native communities.

Invasive plants can expand the window of opportunity for burning and can increase the intensity of fires in riparian areas. Fires in native riparian vegetation tend to occur only during periods of extreme drought. The fires typically remain in the surface vegetation and are of relatively low to moderate intensity. In contrast, fires that are supplemented by invasive vegetation can occur under a broader range of environmental conditions and climates, often spread into the canopies of riparian woodlands and forest, and can reach very high intensities. Native riparian trees, such as sycamores, cottonwoods, and willows, do not generally recover well from high-intensity fires that reach into their canopies, whereas non-natives plants such as saltcedar (*Tamarix* spp.), Russian-olive *(Elaeagnus angustifolia)*, and giant reed *(Arundo donax)* recover quickly from even the highest-intensity fires.

Figure 5. *The site again in December 2007 when another wildfire burned through the area carried by the invasive grasses, setting the recovery process back to the beginning again. Photo: Carl E. Bell.*

Wildfires can directly affect animals as well, especially species that are small or have limited mobility. However, the habitat changes caused by fires can exert an even greater influence on animal communities. For example, when shrubland is converted to grassland, shrubland animals are replaced by grassland animals. This is not always negative, especially if the shrublands and grasslands exist in a patchwork distribution across the landscape, allowing regional coexistence of animals adapted to each community. In addition, under a natural fire regime grasslands may persist for only a few decades before they are replaced by shrublands. This allows for different animal species to coexist in the same space, but during different postfire time periods. When invasive plants lead to larger or more frequent wildfires, the overall diversity of animal communities typically declines.

Invasive Plants of Greatest Concern

Annual Grasses

Almost all of the common grasses in southern California are non-native species from Europe and the Mediterranean, including wild oats (*Avena* spp.), bromes (*Bromus* spp.), and ryegrasses (*Lolium* spp.) (see fig. 4). In general, native grasses were perennial species that lived through the dry summers. Unlike native perennials, non-native annual grasses germinate in the winter and complete their life cycle before summer. Their dried tissues can provide fuel throughout the summer and fall fire season. Mature grass seeds that fall to the ground in early summer will escape damage from high fire temperatures. In the desert, red brome *(Bromus rubens)* and mediterraneangrasses (*Schismus* spp.) provide continuous fuel that can lead to large fires. Repeated burns in these areas have caused a conversion from native perennial desert scrub to non-native annual grassland.

Perennial Grasses

Giant reed *(Arundo donax)* is the most common invasive plant in riparian areas of southern California. Because it grows in dense masses to as high as 30 feet (9 m) tall, it creates a large amount of biomass that becomes dry and flammable in the fall. Fires in these areas are expansive and intense, and flames spread easily from the surface into the canopies of the tallest native trees. Soon after a fire, giant reed resprouts quickly from its large rhizome system. By comparison, natives recover very slowly. Gaps left on the riverbanks provide invasion points for other weedy plants, such as castorbean *(Ricinus communis)*, perennial pepperweed *(Lepidium latifolium)*, and poison hemlock *(Conium maculatum)*.

Pampasgrass *(Cortaderia selloana)* is a large clumping grass, about 6 to 8 feet (1.8 to 2.4 m) tall. It is a weed of coastal sage scrub and the upland riparian zones. Although it remains green year round, it can readily burn because its old leaf litter and dead flower plumes provide ample fuel. The large clumps can become massive torches and can hinder access for fire fighters.

Crimson fountaingrass *(Pennisetum setaceum)* is a smaller clumping grass that can establish in a wide range of sites in southern California. After the San Diego wildfires of 2003, it was often the first plant to resprout along streets and highways. Like pampasgrass, it stays green year round, but the leaf litter and old shoots easily burn.

Herbaceous Broadleaf Plants

As with the non-native grasses, southern California has numerous Mediterranean forbs (herbaceous broadleaf plants) introduced by European immigrants. These species grow readily during the rainy season, then die or go dormant by the beginning of the summer fire season. Examples include various annuals including mustard species (*Brassica* spp.) and filarees (*Erodium* spp.), as well as biennials or perennials including fennel *(Foeniculum vulgare)* and thistles (*Cirsium* spp.). These species do not usually produce as much fine fuel as annual grasses, but their dried seed stalks burn and the seeds within the soil are not damaged or killed by fire. Since they are early germinators like the annual grasses, they can out-compete the natives. In the desert, Saharan mustard *(Brassica tournefortii)* produces large amounts of fuel that, when combined with an understory of annual grasses, can be an important contributor to the wildfire problem.

Woody Trees and Shrubs

Several woody invaders, such as saltcedar (*Tamarix* spp.), acacias (*Acacia* spp.), and eucalyptus (*Eucalyptus* spp.), readily burn and recover soon afterwards. Like giant reed, these are often invasive in riparian habitats, where they increase the frequency and intensity of fires. Saltcedar in particular is responsible for intense summer fires along desert rivers. Fires associated with

saltcedar have eliminated stands of native mesquite, cottonwood, and willow along the Colorado River.

What Can Be Done about This Problem?

The first defense is to prevent the establishment of or to remove invasive plants from natural habitats. This can be accomplished by supporting the efforts of private and public organizations working to eliminate or manage invasive plants. It is especially important to read and follow posted instructions at the entrance of parks, forests, and preserves that warn against introducing or spreading invasive plants. It is also important to incorporate invasive plant control protocols into wildfire planning and management, as with the following suggestions.

Creating fire and fuel breaks is often an essential part of fighting, or being prepared to fight, a wildfire. However, fuel breaks can also be a pathway for non-native plants to invade new territory. Appropriate weed control practices should be part of fire break and fuel break construction and maintenance. These practices might include cleaning equipment before and after entering fuel or fire breaks, planting native species of low flammability as ground cover to compete with more flammable non-native species in breaks, and mowing breaks in late spring after weedy annuals have stopped growing but have not yet produced viable seed.

After a fire, there is often a desire to facilitate recovery of the vegetation within the burned areas, especially on slopes that might erode during the winter rains. In the past, it was common to seed areas with fast-growing annual plants, typically non-native annual ryegrass or collections of native and non-native forbs. This practice is no longer recommended because the results are not usually successful. In most cases, heavy rains wash away seeds or inadequate rainfall prevents good seed germination. In addition, some of plants used for reseeding can persist in the site and became invasive. These non-natives can compete with the native vegetation and prevent recovery. Long-term slope stabilization is better achieved by promoting the recovery of deep-rooted perennial shrubs rather than the shallow-rooted annuals. This can be accomplished by transplanting shrubs or by protecting establishing shrubs from herbivory or competition from non-native species. Recovery of native shrubs can be hindered by the seeding of non-native annuals.

Mulches, straw bales, and straw wattles are sometimes used to temporarily hold soil in place until the native vegetation can reestablish. Care should be taken to select and inspect these materials so they are not a source of invasive plants. The use of certified weed-free hay is good policy.

After a fire, the majority of plant material is consumed, so access to the areas can be much easier. This can provide an opportunity to employ weed control for much less cost and effort. The method of control, however, should consider impacts on soil. The use of heavy equipment, grazing animals, or even heavy foot traffic can lead to increased erosion on slopes or compaction of fragile desert soils. Mechanical techniques such as mowing, weed wiping, or hand hoeing or pulling can be very effective on small patches. In other cases, the application of selective herbicides or the directed application of a nonselective herbicide on targeted vegetation can be most effective and affordable.

For more information on control of invasive plants visit the following Web sites: Weed Research and Information Center, http://wric.ucdavis.edu/; Invasive Plants in Southern California, http://groups.ucanr.org/socalinvasives/; and the California Invasive Plant Council, http://www.cal-ipc.org/.

Using Fire for Invasive Plant Control

Fire can also be used to manage ecosystems by removing vegetation. In some grassland areas, controlled burns at the right stage of native and non-native plant growth can reduce the weedy plants and increase native bunchgrasses. In other cases, burning damages natives and creates gaps for the establishment of invasive plants. Like all other weed control practices, including herbicides, mowing, or tilling the soil, burning has to be used properly and should be integrated with other methods. In some cases intentional fires can be incorporated with revegetation of native plants. Burning is also a good way to remove dead biomass and expose target plants to a follow-up herbicide treatment.

References

Brooks, M. L., C. M. D'Antonio, D. M. Richardson, J. B. Grace, J. E. Keeley, J. M. DiTomaso, R. J. Hobbs, M. Pellant, and D. A. Pyke. 2004. Effects of invasive alien plants on fire regimes. BioScience 54:677–688.

DiTomaso, J. M. and D. W. Johnson, eds. 2006. The use of fire as a tool for controlling invasive plants. Berkeley: California Invasive Plant Council Publication 2006-01. Cal-IPC Web site, http://www.cal-ipc.org/ip/management/UseofFire.pdf.

DiTomaso, J. M., M. L. Brooks, E. B. Allen, R. Minnich, P. M. Rice, and G. B. Kyser. 2006. Control of invasive weeds with prescribed burning. Weed Technology 20:535–548.

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