

native vegetation and prevent recovery. Long-term slope stabilization is better achieved by promoting the recovery of deep-rooted perennial shrubs compared to shallow-rooted annuals. 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 re-establish. 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.



A fire the previous year, fueled by non-native grasses, burnt through this stand of Joshua trees leaving scarred trunks. The Joshua trees died a few years later. This area will probably take 50 to 100 years to fully recover, providing there are no more fires.

Fire for invasive plant control:

Fire is also a tool 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 establishment of invasive plants. Like all other weed control practices such as herbicides, mowing, or tilling the soil, burning has to be utilized properly and should be integrated with other methods. In some cases intentional fires can be incorporated with re-vegetation of native plants. Burning is also a good way to remove dead biomass and expose target plants to a follow-up herbicide treatments.

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.

Wildfire Zone is a new education and outreach program at Cooperative Extension in San Diego County created to increase awareness of wildfire risks and hazards and to offer tips on how they can be reduced.

Go to www.wildfirezone.org for more regional wildfire information.

Photo Credits:

Front cover photo of fire, by Dan Megna, SDSO
Recovery Photo (front cover), by Ty Berlanga, DPW-Cartographic Services
All other photo's courtesy of Carl E. Bell, Regional Advisor-Invasive Plants



¹ Regional Advisor-Invasive Plants, University of California Cooperative Extension, San Diego, CA;

² Extension Weed Specialist, Cooperative Extension, University of California, Davis, CA; and

³ Research Botanist, Western Ecological Research Center, US Geological Service, Henderson, NV.

The University of California prohibits discrimination against or harassment of any person on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized). University policy is intended to be consistent with the provisions of applicable State and Federal laws. Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Drive, Oakland, CA 94612 (510) 987-0096.

University of California, County of San Diego, and the United States Department of Agriculture cooperating.

Invasive Plants and Wildfires in Southern California



Carl E. Bell¹, Joseph M. DiTomaso² and Matthew L. Brooks³

¹University of California Cooperative Extension, San Diego;

²University of California Davis; and

³U.S. Geological Survey, Henderson, NV

Wildfires are a regular and natural occurrence in most of southern California. Some of the common native vegetation types, especially chaparral, coastal sage scrub, and valley grassland habitats, which occur from near the coast to elevations of 3000 ft, are well adapted to fires and 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. The deserts, of all native ecosystems in southern California, have the least history of wildfires, because of the sparse and discontinuous vegetation and are the least adapted to fire.

In all of these different 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 re-establish more rapidly than native plants, suppressing the recovery of the natives and allowing the weeds to expand their range. In addition, if fires occur too frequently, some of the native vegetation loses the ability to recover at all, effectively converting high diversity native plant communities into low diversity non-native communities.

Invasive plants can increase the window of opportunity for burning and increase the intensity of fires in riparian areas. Fires in native riparian vegetation tend to occur only during periods of extreme drought. They 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 river 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.*) and giant reed (*Arundo donax*) recover quickly from even the highest intensity fires.



This photo was taken two months after the Olay fire in San Diego County, 2003. Notice the first plants emerging from a recent rain are non-native grasses.

Wildfires can directly affect animals as well, especially species that are small or with 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 both shrubland and grassland animals. 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 post-fire time periods. When the fire regime is changed by invasive plants, either by allowing fires to become larger and thus reducing the spatial patchwork of vegetation type, or by changing the frequency of fire and possibly preventing later successional vegetation types such as shrublands to re-establish, the overall diversity of animal communities declines.

the invasive plants of greatest concern are:

Annual Grasses

Almost all of the grasses common in southern California today are non-native species from the Old World. These include wild oats (*Avena spp.*), bromes (*Bromus spp.*), ryegrasses (*Lolium spp.*), and a few others. These 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.*) helped fuel large fires that have repeatedly burned some areas and converted them from native perennial desert scrub to non-native annual grassland.



This photo was taken 15 months later in March 2005. The lighter green is all invasive annual grasses

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 20-30 ft 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 re-sprouts quickly from the large rhizome system. By comparison, natives recover very slowly. Gaps left on the river banks provide invasion points for other weedy plants, such as castorbean (*Ricinus communis*) and poison hemlock (*Conium maculatum*).

Pampasgrass (*Cortaderia selloana*) is a large clumping grass, about 6 to 8 feet tall. It is a weed of coastal sage scrub and the upland areas of riparian zones. Although it remains green year round, it can readily burn because its old leaf litter and dead flower plumes provide ample flammable fuel. The large clumps can become massive torches and hinder fire fighter access to burns. Fountaingrass (*Pennisetum setaceum*) is a smaller clumping grass that can establish in wide range of sites in southern

Examples include various mustard species (*Brassica spp.*), filarees (*Erodium spp.*), fennel (*Foeniculum vulgare*), and thistles (*Cirsium spp.*). These species do not usually produce as much fine fuels as do the grasses, but their dried seed stalks burn and the seed 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



Post-fire creek in San Diego County. Willow trees are recovering from the base, but the invasive eucalyptus on the right is re-sprouting along the trunk.

California. After the San Diego wildfires of 2003, it was often the first plant to re-sprout along streets and highways. Like pampasgrass, it stays green year round, but the leaf litter and old shoots easily burn.

Herbaceous Broadleaf Plants

Like the non-native grasses, southern California has numerous Mediterranean forbs (herbaceous broadleaf plants) introduced by European immigrants. These winter annuals grow readily during the rainy season, then die or go dormant by the beginning of the summer fire season.

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. In some cases, 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 or 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 materials 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 into wildfire planning and management. The following are some suggestions:

The creation of 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 the fire/fuel break construction and maintenance. These practices might include; cleaning equipment before and after entering fuel/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 rainy period. In the past, it was common to seed areas with quick 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 some cases, it rains too much and the seed washes away, or perhaps it does not rain enough for good seed germination. In addition, some of plants used for re-seeding can persist in the site and became invasive. These non-natives can compete with the