FIRE-RESISTANT LANDSCAPING: A GENERAL APPROACH AND CENTRAL COAST PERSPECTIVE

by Suzanne Schettler

When planning a landscape in a rural-residential area, it is a natural impulse to consult a list of fire-resistant plants and select only those that are deemed fire-safe. Consulting more than one list can uncover a problem, however: lists contradict each other. For example, our native yarrow (*Achillea millefolium*) shows up on some lists as fire-resistant and on others as flammable. Other species show up in contradictory fashion as well. Most lists are a compilation of opinions, guesses, informed guesses, and other people's guesses.

THE WILDFIRE ENVIRONMENT

Some factors in the fire environment are beyond human control, and are almost beyond comprehension. First, wildfires are extremely unpredictable, burning some vegetation while adjacent sites are left untouched. Second, the rapidly rising column of hot air from a wildfire sucks in oxygen to feed the base of the fire, creating winds of tornado speeds. These high winds carry burning embers (firebrands) a mile or more, igniting spot fires in a leapfrog fashion and spreading the fire farther and faster than the actual flame front. Firebrands are not necessarily single burning coals; they can be a shower of small embers, resembling Fourth of July fireworks but not organized into pretty patterns. And third, because wildfires often occur during especially hot, dry, and windy weather conditions, the temperatures can be extremely high. After the Trabing Fire near Watsonville in 2008, investigators determined that the temperatures had reached 3,000 degrees Fahrenheit. I was shown a blob of melted aluminum, small enough to hold in the palm of a hand, that was all that remained of an extension ladder.

Some comparative temperatures may be of interest. Paper ignites at about 451 degrees F, depending on its composition. Lead melts at 400 to 600 degrees F, depending on its purity. Aluminum melts at about 1,600 degrees F, a blast furnace for making steel runs at approximately 2,300 degrees F, and a kiln for cement production is fired at 3,000 degrees F.

There are no plants and no structures that can withstand such heat. At these temperatures, spontaneous combustion ignites a structure from within. As the Basin Complex Fire in Big Sur approached a home in 2008, the owners moved their important possessions into a metal storage container on the property before they evacuated. When they returned, the house was untouched but the storage container held only ashes. Such incidents of internal ignition happen more often than we think.

WHAT WE CAN DO

In spite of these formidable conditions, we are not helpless. Second graders are taught the Fire Triangle (see page 18). The three sides of the triangle are heat, oxygen, and fuel—take away any one of them and fire cannot burn. There is little that can

Low-growing native plants minimize potential fire hazard immediately adjacent to this home. Native irises (*Iris* spp. and hybrids), sea thrift (*Armeria maritima*), *Phlox douglasii*, and low-growing manzanitas (*Arctostaphylos* spp.) are featured. Horizontal separation between plants is illustrated by the walkway at the left and center, and vertical separation is illustrated at the right. However, as the vines growing up the house increase in size they could become a fire hazard. The homeowners might want to replace them with low-growing plantings in large ornamental pots. Photograph by landscape architect R. Lutsko, reprinted with permission of *Pacific Horticulture*.

be done to reduce the industrial temperatures described above. And oxygen cannot be cut off unless a fire is small and can be smothered. The one element we can control is fuel, and vegetation is fuel. We can control the vegetative fuel when we design a new landscape or retrofit an existing one.

HOW FLAMMABLE ARE NATIVE PLANTS?

Bert Wilson is a native plant nursery owner and former firefighter. In September of 2005, near the end of the dry season, he compared the flammability of various plants. He placed a one-centimeter flame of a propane torch in contact with foliage of a clipped branch and recorded the time to ignition, repeating several times per plant. Most of the native plants he tested were growing in the ground and were unwatered. He performed the experiment in a closed barn so breezes would not influence the results.

What he found was not what he expected. The results were not consistent, either within genus or species, or with the literature. The more drought-tolerant the plant, the longer it took to ignite. And unwatered natives fared better than watered nonnatives; a watered apple and a watered common lilac burned faster than many manzanitas. Manzanitas as a group were quite variable, and watered samples were not necessarily slower to ignite than unwatered ones. Ceanothus species were relatively hard to burn; a light dust-off by overhead watering every two weeks made them really hard to burn.

SOME GENERALIZATIONS

In spite of the fallibility of lists of "fire-resistant" or "fire-prone" plants, there are some general guidelines that do relate to species selection. Plants with fine foliage have a high surface-to-volume ratio and therefore are more quickly heated through to an ignition temperature than are larger leaves. Conversely, plants with larger, thicker leaves are slower to ignite. Plants with resinous sap are chemically more volatile than plants with watery sap. Conifers (except for redwoods) are generally fairly flammable. Species that accumulate dry litter are a hazard. But even these guidelines are relatively minor factors in reducing flammability.

Here interest is focused away from the house, which is casting a late-afternoon shadow across the patio and lawn. The perennial border creates a focal point viewed *from* the house, rather than framing the view *toward* the house. Bulky vegetation is farther back, blurring the property line. All photographs by S. Schettler unless otherwise noted.

SEPARATION IS THE KEY

The question is not "Is a particular species fire-resistant?" What really makes a landscape fire-resistant is not the species that are planted but the three-dimensional geometry of their placement and the kind of care they receive. The spaces between plants, and the space between vegetation and a structure, are of great importance. There should be horizontal and vertical gaps in the vegetation. The individual plants should have elbow room, not just when they are initially planted but when they are full-grown. It may be useful to consult a knowledgeable horticulturist in advance to identify the mature size of plants in a given soil type and climate. And bulky vegetation should be positioned away from structures. The area immediately surrounding a home can function as a firebreak, comprising low vegetation or hardscape. This also becomes a work area if firefighters are defending a home and are lugging heavy hoses to protect the structure.

DESIGN FACTORS

Foundation plantings evolved when it was considered unsanitary for the first floor of a house to sit close to the ground and plants were needed to camouflage a tall foundation. Thomas Church and other landscape architects began moving away from this approach in the mid-1900s. Rather than using plants to frame the view of the house from the street, they placed the plantings where they can be enjoyed looking outward from the house and patio. This removes the bulk of the vegetation (fuel) from near the house, literally turning the design inside-out and creating fire resistance at the same time. For fire resistance, it is important to graduate the vegetation, with least volume near the structure.

In a fire-resistant landscape, a traditional perennial border is not located at the foundation of the house, but is set at a little distance where it invites exploration. This concept translates readily to our Mediterranean climate.

THERE IS NO SUCH THING AS A FIRE-PROOF PLANT…

Iceplant (*Carpobrotus edulis*) burned in the Trabing Fire in 2008. Photograph by R. Casale, NRCS.

…OR A FIRE-PROOF STRUCTURE.

(*Before*): Mike Evans, co-owner of Tree of Life native plant nursery in Southern California, built this cabin over the course of three years. The cabin was carefully designed for fire safety, there was 100' clearance to mineral soil in all directions, and the forest understory was cleared for hundreds of yards all around. Both photographs by M. Evans.

(*After*): The Cedar Fire of 2003 burned so hot that the structure fire started on the inside: a piece of furniture, a pillow, a towel, the tablecloth (who knows?) ignited, perhaps spontaneously.

Islands are a good way to create separation in the vegetative fuel. They can either form the framework for the layout of a new landscape or can be retrofitted by cutting broad trails through existing vegetation such as chaparral, breaking it up into discontinuous patches. Human-scale islands of mounded vegetation visually remind us of natural topography in the larger landscape, so that one has the experience of being immersed in the landscape rather than merely walking over it.

Since fire climbs upward, it is important to eliminate fire ladders. A fire ladder exists when there is continuous or nearly continuous vegetation extending from the ground up to the tree canopy. Care in the placement of shrubs, and maintaining substantial vertical gaps between shrubs and trees, can prevent the development of fire ladders.

Steep slopes are particularly vulnerable to fire, as fire low on the slope preheats vegetation higher up. Terracing a steep slope makes the site more useable, allows rainfall to soak in rather than run off, and reduces the intensity of a potential fire. A tree or shrub burning low on the slope cannot readily ignite a plant higher up if the slope is broken by level areas.

Homeowners in forested settings are being increasingly encouraged by Cal Fire and local fire agencies to reduce hazardous vegetation and create defensible space (see sidebar). This is accomplished through a combination of methods. Dense trees can be thinned to feature the most attractive and well-spaced specimens. In a mixed evergreen forest, understory shrubs and ferns that remain after some trees are removed can provide the basis for a new garden. Trees that are retained should have their lower branches removed to eliminate fire ladders; the remaining foliage should be at least high enough to walk under. Shrubs can likewise be "limbed up" and selectively pruned to showcase beautiful

trunks while reducing fuel and creating separation from the ground-level vegetation.

HORTICULTURAL PRACTICES

Aside from the three-dimensional geometry of the planting, the single most effective fire-resistant measure is to perform horticultural maintenance on a regular basis: groom, dead-head, prune, rake, tidy up. Fire ladders that have been initially eliminated may need to be maintained by periodically reopening the vertical gaps as plants grow.

Mulch conserves moisture and suppresses weeds, but wood chips or bark should not be deeper than 3-6" in order to limit flame lengths. In the event a firebrand lands on it and smolders, the mulch should be kept a few feet away from structures so it can't carry a creeping fire to a building.

Irrigation can sustain moisture content in the vegetation through the dry season, making it slower to ignite. There is a delicate balance, however. The life of drought-tolerant trees and shrubs is shortened if irrigation stimulates year-round growth and the plants do not have a natural annual dormancy during the dry season. The best basic irrigation regime is to mimic a good, long rainy season. Watering can start about October 1, be discontinued once rains begin, resumed again when the rains end, and then tapered off during May.

Most shrubs of the chaparral have a deep taproot but also have branch roots near the ground surface to collect water from showers that wet only the upper soil layers. If supplemental watering is desired during summer, it should be infrequent and light. Here again, nature is the model. In the Central Coast region of California, natural rainfall in summer is rare and light.

Some plants can provide cues for the timing of summer watering. Bush monkeyflowers (the woodier *Mimulus* species) can be used as indicator plants; when they start to look dry and wilted, other plants in similar conditions will benefit from a light watering. The monkeyflowers are an exception to the requirement for summer dormancy and can even be kept in nearly continuous bloom if they are cut back halfway after bloom and then watered. Bush monkeyflowers are usually deer-proof and fully drought-tolerant, and are more versatile than many natives. They are on some fire-resistant plant lists, but Bert Wilson's experiment found that when they are dry and dormant they ignite readily.

DEFENSIBLE SPACE

By law in California, 100 feet of defensible space is required around homes and other structures. This creates a safe working area for firefighters to protect structures.

First 30 feet: "Lean, Clean, and Green"

Vegetation must be very low in volume and density. This does not translate to a barren moonscape, but it does mean low groundcovers and/or hardscape are dominant.

Next 70 feet (or to the property line if closer):

"Reduced Fuel Zone"

Create horizontal and vertical spacing between plants. The amount of space will depend on how steep the slope is and the size of the plants.

In Santa Cruz County, islands of low vegetation less than waist high may be scattered in the Reduced Fuel Zone for aesthetic and wildlife values. Some examples for different areas are listed below:

For Sun

manzanitas (*Arctostaphylos* spp., low-growing forms)
coyote bush (*Baccharis pilularis*)
ceanothus (*Ceanothus* spp., low-growing forms)
sedges (*Carex* spp.)
buckwheats (*Eriogonum* spp., low-growing varieties)
irises (*Iris* spp. and hybrids)
sages (*Salvia* spp.)

For Part Shade

huckleberry (*Vaccinium ovatum*)
irises (*Iris* spp. and hybrids)
snowberry (*Symphoricarpos albus*)
California blackberry (*Rubus ursinus*)
alum root (*Heuchera* spp.)

For Shade

western bleeding heart (*Dicentra formosa*)
western sword fern (*Polystichum munitum*)

CONCLUSION

One way to think about fire-resistance is to landscape as if you have a view: keep plenty of space open so you don't block the view. If you don't have a view, make one by

TOP: **A combination of thinning and limbing up creates a shaded fuel break, reducing the intensity and speed of a potential fire. This is a sensitive way to handle rare shrubs such as silver-leaf manzanita (*Arctostaphylos silvicola*). To prevent erosion, the ground has not been scalped (cleared to bare soil).** • MIDDLE: **Island plantings are a good way to create separation in the vegetative fuel surrounding homes. Their presence reduces the spread of wildfire, while adding focal interest to the landscape. Here, a small island planting is located between two larger islands in the salvia garden at Cabrillo College in Santa Cruz County. More island plantings can be seen by zooming in to the Google Earth view of the UCSC Arboretum.** • BOTTOM: **Where space is available, a perimeter orchard of dwarf fruit trees can create a fuel break.**

placing a garden structure or featured plant where it creates a focal point away from the house. Another way to think about fire-resistance it to picture a chess game after the game is halfway played and the remaining pieces are widely scattered across the board. There may be a cluster or two, but there are broad open spaces as well.

There are other considerations that contribute to fire-resistance in a landscape, but the two most important ones are plant geometry and horticultural practices. Although there can be no guarantees in the event of a wildfire, effective design and horticultural practices can dramatically shift the odds in one's favor.

There are many ways to accomplish a balance of defensibility, aesthetics, and ecological value. Three similar properties on a given hillside may achieve all these goals in three different ways.

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