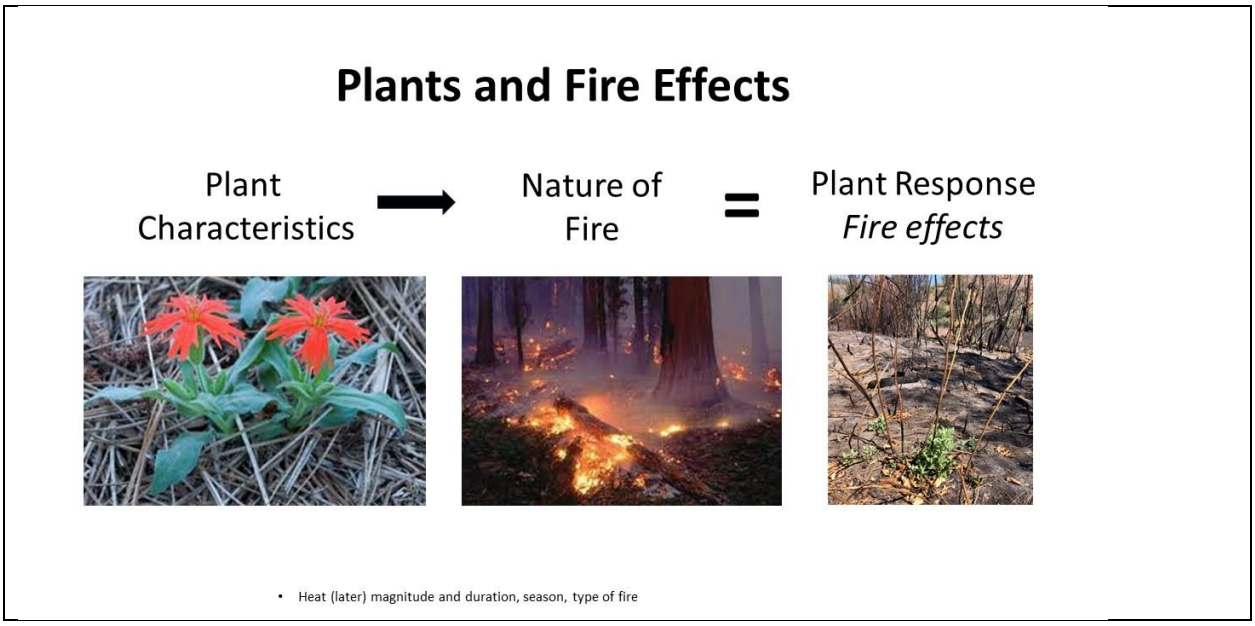
Fire Effects

Fire effects are how plants, soil, watersheds, wildlife and other parts of forests are affected by fire. This may be positive or negative. The effect depends on what the fire is like and the characteristics of the forest or plants or wildlife. Knowing about the basics of fire effects is important to understanding how to conduct prescribed burns and manage fire so that the results are desirable.



Plants

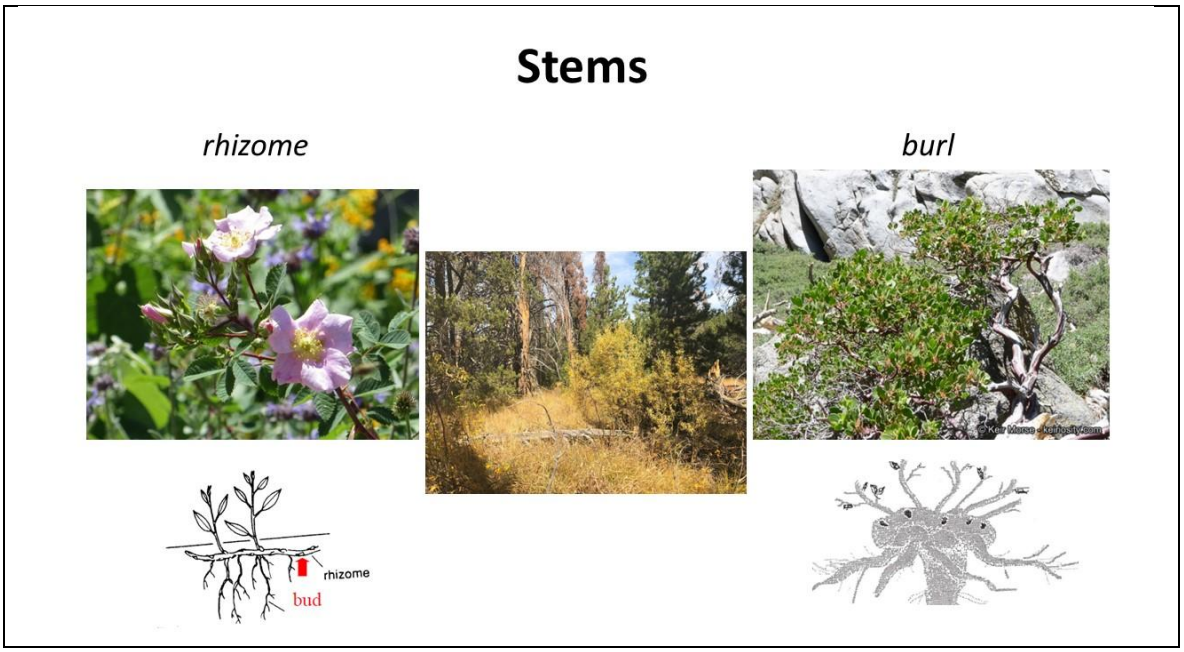
Plants have many different ways that they grow, survive and respond to fire. Many of the plants In the northern Sierra Nevada and in much of the western US and other parts of the country and globe with frequent fire have features and characteristics that let them survive and even thrive with fire. They are adapted to fire. This includes the ability to sprout or regrow from underground parts that are insulated from heat by soil. Trees may have thick bark or large buds that insulate and protect living tissues from heat. Some have seeds that are stimulated to germinate with the heat or smoke from fire. Others are able to germinate better on bare soil that has been burned. Some of these characteristics for common plants in the northern Sierra Nevada are shown below.

Sprouting After Fire

Many perennial plants, that grow more than one year, are able to grow new leaves and stems after their tops are lost from fire or cutting or browsing by animals. This is the most common way that plants survive fire. When the top of a plant is removed or dies, it sends a hormonal message to the plant to grow new leaves and shoots from buds or bulbs or tubers. All plants that sprout have some structure or part that can store energy to support the new growth. Below are examples of the common ways plants sprout after fire.

Stems

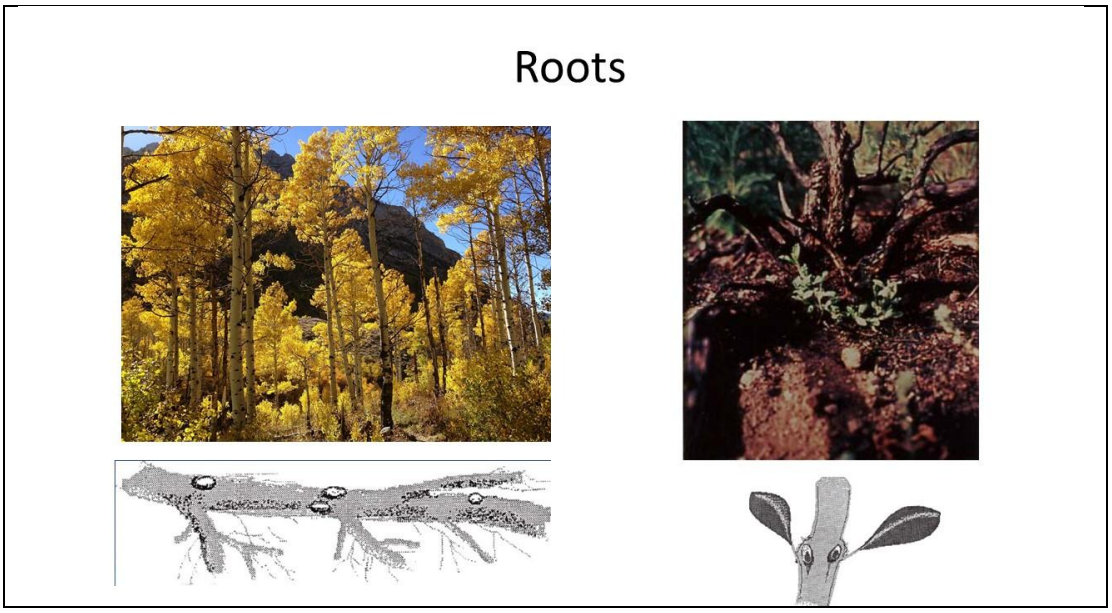
The buds may be on the roots, in the case of aspen. Others sprout from buds on stems that spread underground, such as wild rose or kitkitdizze or bearclover. Oaks, madrone and some manzanitas sprout from “burls” or swollen areas at the base of the stems. Grasses and some shrubs such as bitterbrush sprout from the crown of their roots, where they meet the stems.



Roots

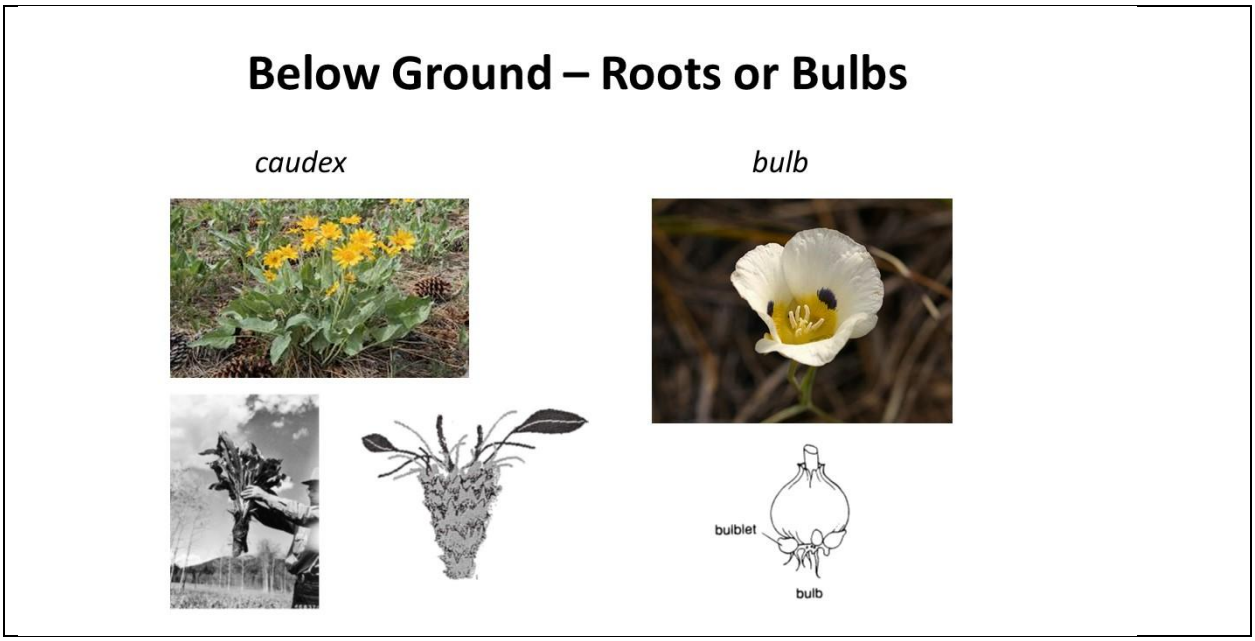
Aspen is the most wide-spread plant that sprouts from roots. An entire patch of aspen is usually all one plant, interconnected by roots that sprout following fire. Aspen are not tolerant of shade and in the absence of fire, conifers that don't sprout are able to grow underneath them and eventually grow up and shade out the aspen. Aspen is considered a fire dependent plant.

Bitter brush, found in eastside pine forests, sprouts from the crowns of the roots where they meet the stem. Since the buds that sprout are close to the soil surface, they are not as well insulated from heat by soil. They are considered "weak" sprouter because sometimes they sprout and survive better than others, depending on how old they are and how hot the fire is. It is a favored food source for deer.



Below Ground Bulbs, Tubers, and Other Structures

Lilies are one of the best examples of plants that sprout from bulbs and can survive a long time. Many are stimulated to flower from the heat of fire. The Mariposa lily is one example. Many native plants with bulbs were an important food source for Native Americans and they tended patches of these plants with fires and other cultivation methods. Other examples include the caudex, or carrot like structure, of Mule's Ears. Other examples include wild iris sprouts from underground corymbs and the delicate looking starflower that sprouts and spreads from little tubers.

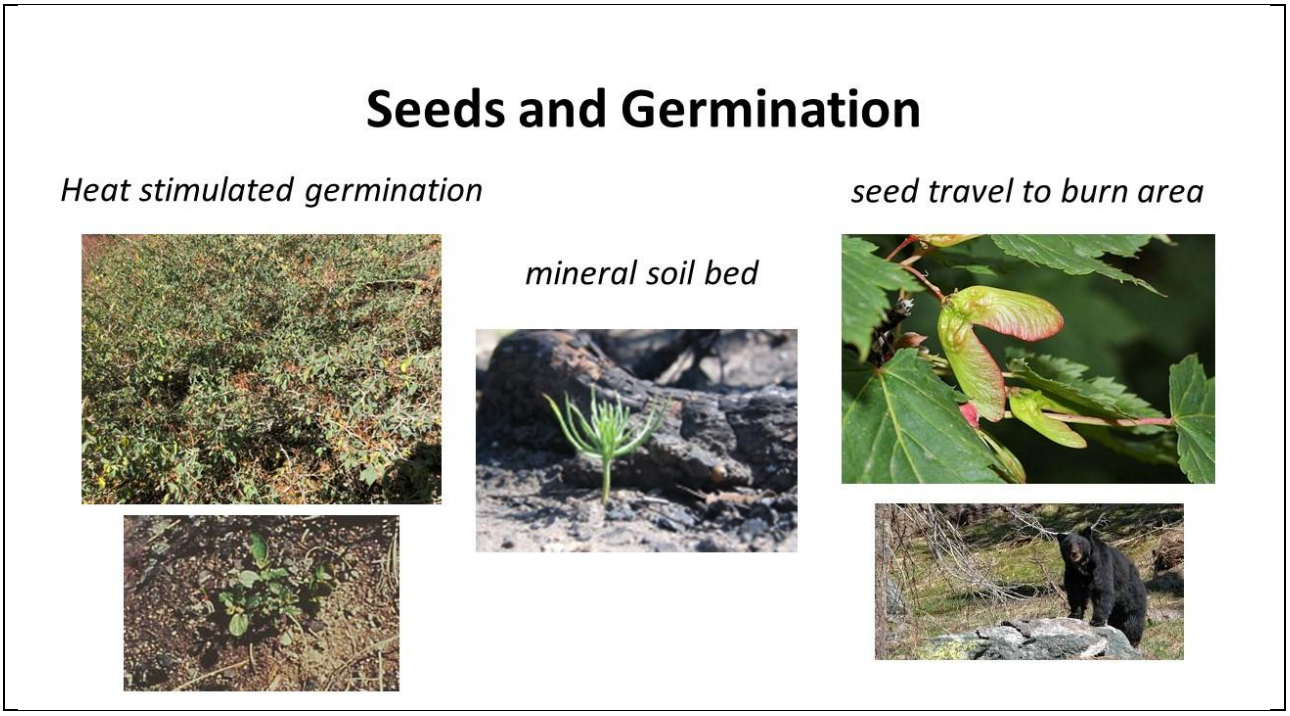


Seeds and Germination

Some plants respond to fire by utilizing the bare mineral soil that is exposed. Seeds germinating on bare mineral soil are able to send their roots down into the soil where there is water and nutrients. This is especially important into dry environments and areas, where seeds need moisture from the soil. Without fire, dry deep litter and duff can cause the roots to die before they reach the nourishing soil. Pine seedlings are a good example of a plant that needs mineral soil to germinate the best.

Seeds travel to burned areas in different ways. Some have wings that enable them to move in the wind or air currents like pine and maple seeds. Others have barbs or are sticky and attach to the fur of animals, like bear, that walk into burned areas.

Other plants have seeds that are stimulated to germinate from the heat of fire. This includes all of the types of Ceanothus including whitethorn and deerbrush. Unfortunately, the invasive scotch and French broom shrubs have seeds that also germinate from the heat of fire and germinate well on bare mineral soil. They also sprout, making it hard to get rid of them.

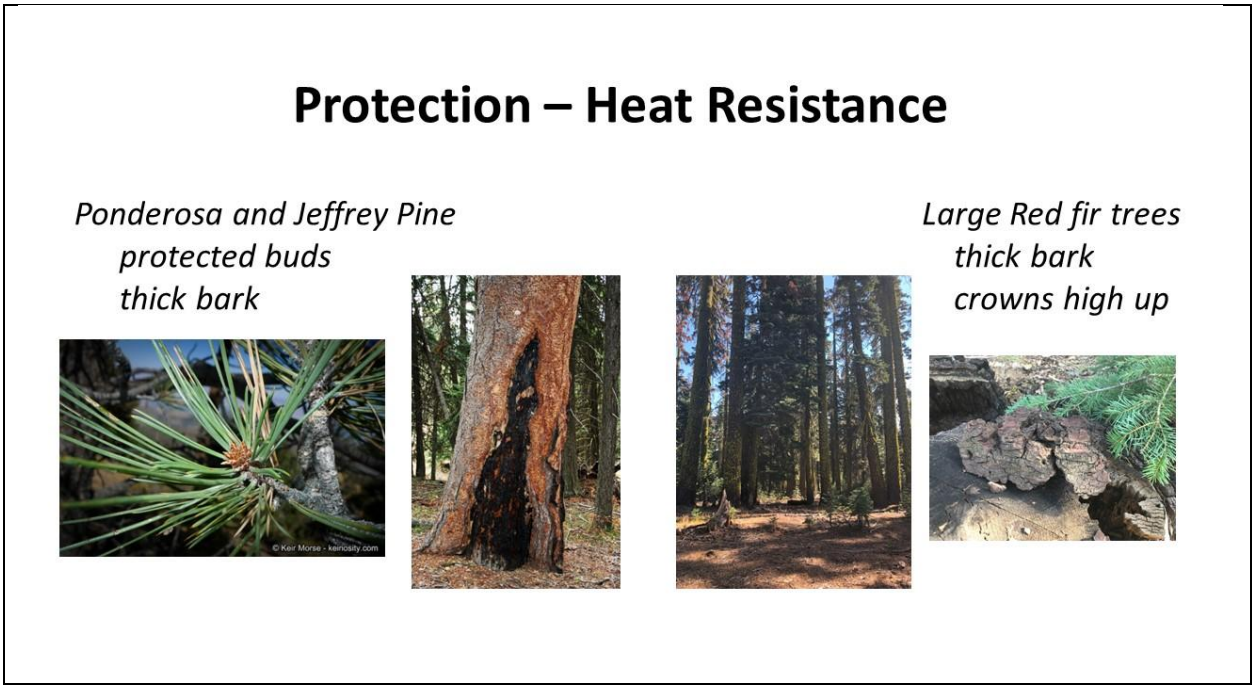


Heat Resistance

A number of the most common trees in the Sierra Nevada are able to survive low and moderate intensity fire because they have features that protect them from heat. Thick bark and large buds protect sensitive living tissues from heat.

Ponderosa pine, Jeffrey pine and giant Sequoia have thick bark that surrounds the living cambium tissue in the stem. Cambium is vital to survival because it is how sugars made in the needles and foliage in the crowns is transported down to feed energy to the roots. Even if part of the stem is exposed or damaged from heat, the trees are able to grow around the scar, much like our skin heals on a wound. It is common to see large pines with triangular scars at the base, where fire has

charred the bark and tissues and it grows back at the edges of the scar. These fire scars are used to reconstruct the fire history. Trees grow a “ring” of tissue around the outside of their stem below the bark each year. By counting the rings in between the scarred areas, it is possible to count which years fires occurred and how many years in between fires.



Some trees, like incense cedar and red fir also develop thick bark but only when they are older. They survive many low intensity fires when they are larger and older but are more susceptible to low intensity fire when they are young and their bark is thin, compared to young ponderosa and Jeffrey pines.

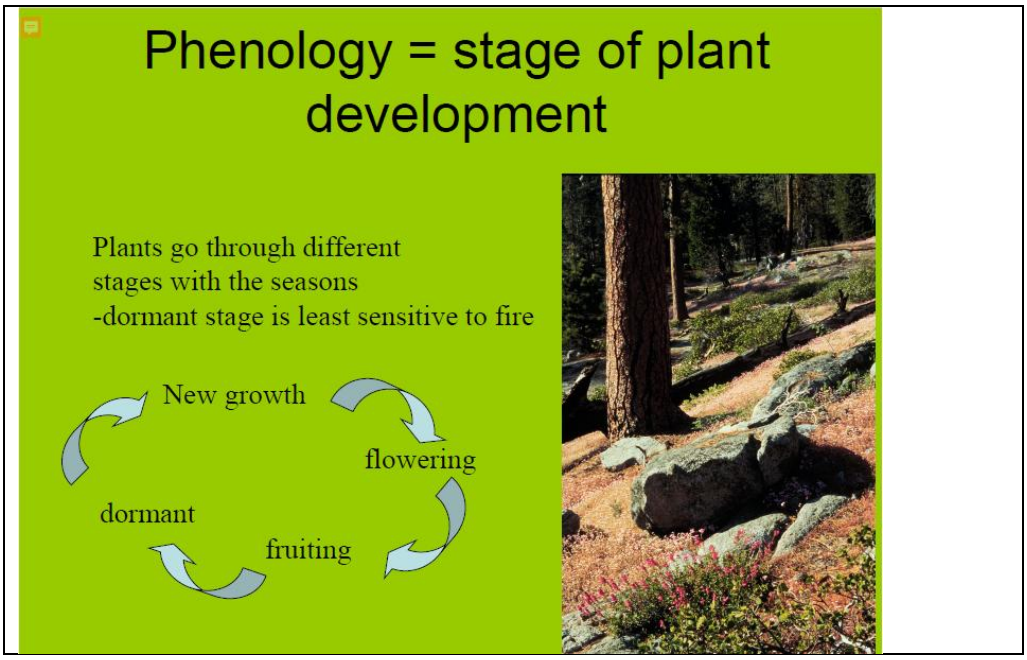
In addition to bark, fire adapted trees like ponderosa and Jeffrey pine have other growth patterns that make them less susceptible to damage from fire. They have buds at the ends of the branches that are large and have more layers of bracts or protective layers, than Douglas-fir or white fir. Because they require more sun, their lower branches die off naturally as they grow up, so that their living branches are higher up from the forest floor, farther away from heat. Incense cedar, white fir, and Douglas-fir tolerate more shade and keep more of their lower branches. This leaves them closer to fire on the forest floor and more likely to catch fire and spread fire up into the crowns or just get heavily damaged.

Lifestyle

Plants are more sensitive to heat and effects of fire at different stages of their life. When plants are actively growing, they are more susceptible to damage from heat.

Annual plants, that grow one year and then die, are susceptible to fire anytime because they have no means to sprout back. They are usually smaller and have fewer insulating features. Some annual plants survive areas with frequent fire by growing early in the year before fire season occurs.

Perennial plants, that grow for more than year, are more sensitive to heat at different stages of development. When they are flowering or developing fruits, they can be the most sensitive. That is because they are using all of their energy to make the flowers and fruits, leaving them less energy to sprout back from fire. Many still survive but they may not have as strong of a sprouting response and only grow more leaves and stems instead of flowers for that year.



Managing Fire Effects

There are several ways that prescribed fires can be managed to minimize negative impacts or unwanted fire effects. There will always be some plants that benefit or thrive after a fire and others that are damaged or even killed by fire. There are several ways to ensure that the desired effects are achieved. This includes managing and controlling the fire behavior, including the intensity, speed, and duration of the fire. There are also many actions that can be taken ahead of time to protect key areas or plants. A fire can also be timed to avoid certain times of the year or stages of plant development.

There are usually multiple reasons that people do prescribed burning. This may include reducing fire and fuel hazard, increasing forest health or enhancing native plants, or all of these. It may not be possible to reach all objectives on any one fire and tradeoffs will have to be made. But for most prescribed burns, they cover a relatively small area and some short-term damage to some plants is not likely to negatively impact native plants in the area as a whole. The damage to some plants may be short-term, in a given year and not affect long-term survival.

Fire Behavior

The best way to get desired fire effects is to control the fire behavior, which is the fundamental to prescribed fire. In general, low intensity, low duration fires are best for both maintaining control of a prescribed burn and achieving desired effects. This means keeping flamelengths low to the ground, generally less than two feet. Plants can be damaged by low intensity fire if it is next to the plant for a long time, a long "residence time". Large trees can be killed by smoldering around their bases for long periods of time. They have smaller feeder roots that grow just below the surface that are important for nutrient and water uptake. These roots are less sensitive to a fast-moving fire with flames of 2 feet than a slow, smoldering burn of more than 1 hour. With large pine in particular, they tend to accumulate mounds of needles and bark at their base. Without frequent fire, the feeder roots start to grow up into this mound. There also may be key habitats for wildlife, mushrooms or moss that a landowner may want to protect from burning.

Actions to Modify Effects

There are several ways to limit the heat and duration of heat to plants that you want to protect.

- Pre-treat the area by pile burning in areas with heavier fuel concentrations.
- Scratch little fire lines around important features that are to be protected. This may include around small patches of certain plants, like sugar pines or a patch of flowers in bloom.
- Around large pine trees,
    - gently raking back some of the upper litter/bark mounds Avoiding expose the roots.
    - Scratch a line around the tree, along the dripline (outside of the crown)
    - Put out fire burning near it, using water or after it burns to keep it from smoldering
    - Use a ring firing pattern, to draw the heat away from the tree.
- Burn in a patchy pattern, leaving some areas less burned or more lightly burned than others.
- Try burning different plants in different stages at different times of year and see how they respond.