

After the Fire – Rebuilding and Land Restoration

Most of the highest wildfire losses take place during hot, windy days or nights when flames spread so fast that many buildings catch fire and overwhelm available firefighting forces. Many buildings ignite when burning embers land on wood roofs, blow in through vents, pile up in cracks, or become lodged under boards. By constructing buildings in a way that reduces the ability of embers to intrude, a major cause of structure ignition is reduced.

Building Materials and Design Considerations

One of the fallacy's about home loss during wildfires is that the loss occurs as the main body of the fire passes. Studies show that building loss during wildfires usually occurs as a result of flying embers (firebrands). Embers are light enough to be blown through the air and can result in the rapid spread of wildfire by spot fires resulting when firebrands are blown ahead of the main fire (in some cases up to a mile). Should these embers land on or near your house, they could easily ignite around or on your home.

Embers are the number one cause of home ignition during a wildfire. Embers are capable of igniting and burning your home in several ways. In order to have a wildfire-resistant home, two equally important factors must be considered: 1) wise selection of building materials and designs that will help the home resist the wildfire; and 2) the home must have adequate defensible space, based on the wise selection, placement, and maintenance of near-home vegetation.

Roof Coverings

The roof covering is the most vulnerable part of a home. Class A roofing materials provide the highest protections and Class C provides the lowest. At a minimum, unrated roofs (such as an untreated wood shake roofs), should be replaced by a rated roof. Class Roofs are commonly available and very affordable.

Roof Edges

The roof edge is vulnerable to wildfire exposures in two ways. The first is when you have debris-filled rain gutters located adjacent to the roof edge. The second occurs with roofing profiles where the design results in large gaps between the roof covering and the roof sheathing.

Rain Gutters

When ignited by embers, the burning debris in rain gutters will provide a flame contact exposure to the roof. The exposure is more severe if metal angle flashes are not used at the roof edge and the gutter is hung below the roof edge, leaving the roof sheathing exposed. The most important thing you can do for the gutter is to keep it clear of debris.

Vents, Attics, and Crawl Spaces

Post-fire investigations of building have provided valuable lessons regarding the vulnerability of vents to firebrands and flame entry. Firebrands directly enter the attic through vents and can ignite fine debris and other combustible materials stored there. Current codes call for vents to be covered with a non-combustible (metal) wire-mesh screen to prevent small rodents from entering these spaces. The building code now allows 1/8-inch mesh screening for vents. This size is certainly better from an ember-intrusion perspective than the previous 1/4-inch mesh screening for vents.

Eaves and Overhangs

The eaves and overhangs of buildings (covered or not) can be vulnerable to fire. Firebrands can congregate in this region of the house, and if near-home vegetation or combustible siding ignites, flames could also reach this area. A wider overhang provides greater protection to the wall and shields the upper portion of the wall from radiant heat.

Some studies show that a boxed-in eave (soffit) protects the rafters from firebrands. It has also been shown that there may be added protection by adding strip vents near the outboard edges of the overhang to minimize firebrand or flame intrusion.

Windows

During a wildfire, an open window is the most vulnerable to flames or embers. Closed windows fail if the glass breaks or if the frame material ignites and burns through into the home.

The most vulnerable part of the window is the glass itself. Homeowners should upgrade to a multi-paned unit (two or three panes), using tempered glass (per California building code). Tempered glass is about four times stronger, and also much more resistant to thermal exposures, than the normal annealed glass commonly found in most windows.

Research conducted in Australia has shown that a reflective film on the exterior surface of the outside glass provides effective protection against radiant exposures (Bowditch et al.2006). Low-E coatings have sometimes been discussed as a means of enhancing the wildfire-resistant performance of windows. Low-E coatings are always on one of the inner surfaces of a dual-pane unit.

Window Screens

Research has shown that window screens improved the performance of glass exposed to radiant heat. Bronze, fiberglass (with polyvinyl chloride coating), and aluminum screens all improved glass performance by increasing the time needed for edge cracks to develop. Bronze screens tested most effective, while aluminum the least effective.

Firebrands will still be able to pass through screens. If the glass in the window has failed, and the screening is still in place, the wind blowing against the screen into the building will result in the ember being reduced in size until it can pass through.

Decks

The vulnerability of your deck to wildfire will depend on the decking board material, any combustible materials stored under the deck or kept on the deck, and the topography, amount, and condition of vegetation leading to the deck. Even though non-combustible decking products are available (such as metal or lightweight concrete decking), many decking products are combustible. Untreated wood and wood treated with fire retardant, as well as plastic and wood/plastic composite products, are all combustible and therefore vulnerable to ember and other wildfire exposures.

Keep your deck free of easily ignited materials such as leaves and needles that may accumulate in the gaps between deck boards and the siding of the house. Metal flashing can be applied to the bottom 18 inches of the wall to protect combustible siding from accumulating embers during a fire. Decayed wood (rotted) is more readily ignited, so periodically inspect for decayed boards and replace them. Typically, other fuel sources contribute to larger deck fires (debris or combustible mater stored under or on top of the deck, or a deck located on a slope containing a lot of combustible vegetation). Avoid storing other combustible materials on and under your deck. If your home is located on a slope, and your deck is overhanging it, your defensible space should be increased to avoid a flame contact exposure during a wildfire.

Exterior Siding

Siding products can be classified into three basic categories: combustible, non-combustible, and ignition resistant. Combustible siding can ignite, with flame spreading up the wall, providing a flame contact exposure to other components on the wall, including windows, eaves, and vents. A second way that fire penetrates, is through the siding (most likely at a horizontal or vertical lap joint in-between siding material), into the stud cavity, and then into the living space of the home. Even with the ignition- resistant siding, the area's most vulnerable to fire ignition are at the lap joints between materials. Use of structural sheathing, located underneath the siding, provides enhanced protection against flame penetration at lap joints.

Fire-Retardant Treatments and Coatings

Exterior rated, fire-retardant-treated (FRT) wood products are pressure-impregnated with chemicals that improve fire-resistant performance characteristics. These wood products undergo a processing step whereby chemicals are fixed or otherwise contained to prevent or minimize leaching of the chemical. This coating protects against fungi and other wood-destroying organisms, as well as weathering protection. Fire-resistant stains and gels can be added for fire protection. These coatings lose effectiveness with time, but there is no data that evaluates the rate at which this reduction occurs. Do not rely on a coating in lieu of managing vegetation or improving building materials or design.

Wildland/*Urban* Interface Building Codes

Over the years, it has become clear that the two most common ways that buildings are lost during wildland fires are from direct heat and flames, or from burning embers that can blow up to a mile ahead of the fire This

knowledge has led to a two-pronged approach in addressing the problem: heat and flames must be kept away from buildings AND the ability of embers to ignite buildings must be eliminated.

California law (PRC 4291) already requires that homeowners clear flammable vegetation within 30 feet of buildings and modify vegetation within 100 feet around buildings to create a defensible space for firefighters to safely protect homes. Ongoing education and inspection are conducted to enforce those requirements. The second component is to construct buildings that resist burning embers. Buildings catch fire when burning embers fall on wood roofs, blow into the building through vents, pile up in cracks or lodge under boards. Ignition-resistant construction creates an “envelope” around the structure to decrease the number of burning embers that can enter the building. By building the structure in a way that diminishes ember intrusion, the main cause of home loss during wildland/urban interface fires can be reduced and even eliminated.

After a thorough and collaborative effort between the California Department of Forestry and Fire Protection (CAL FIRE), Office of the State Fire Marshal, local fire districts, building associations, and other public safety organizations to identify better construction methods and materials to make buildings more ignition-resistant, new wildland building standards have been developed for California’s fire-prone areas.

The following ignition-resistant standards will make homes and businesses more resistant to wildfire:

- enclose Decks with ignition resistant material to within six inches of the ground.
- protect Eaves on the exposed side with ignition-resistant material.
- Roofs built to Class A fire-resistant standards in state responsibility areas and in Very High Fire Hazard Severity Zones in local responsibility areas.
- All under-floor areas enclosed.
- Dual-paned tempered glass for all exterior windows.
- Ignition-resistant materials for exterior doors.
- All exterior vents designed to prevent ember intrusion.

A working group of builders, firefighters, inspectors, researchers, city and county representatives, housing experts, and the insurance industry have worked closely with the State Fire Marshal to develop these standards. The standards are based on lab-tested and verifiable performance standards that describe the type of wildfire exposure a building must be able to withstand. This allows for a wide range of materials and designs.

Land Restoration

Private landowners with wooded areas or non-industrial forestland affected by wildfire are very concerned about what might happen to fire-damaged soils, slopes, and water courses when the rains come.

They are also wondering what can be done now to minimize the effects of erosion and sedimentation processes before any storm events. Still others are questioning whether or not to remove fire-damaged or destroyed trees and other vegetation now, to leave alone or to wait.

The Nevada County Resource Conservation District, provides assessments of fire damages to natural resources and watersheds to landowners and managers at no cost. Some of the more important post-fire actions to take include the following:

- (1) Sign-up for an Advisory Visit assessment of the fire damage done to your property by our NCRCD specialist.
- (2) Don't be too quick to remove fire-damaged trees and other vegetation (especially redwood and coastal live oak trees) that have thick and/ or fire-resistant bark. On some properties, doing nothing may be the best solution, allowing nature to restore vegetative cover naturally. In areas where trees were partially damaged by fire, smoke or heat there will be an enormous leaf drop through the fall that will provide soil protection from rain and runoff in the coming winter. Consult with a RPF or Certified Arborist for specific advice on which trees to cut or save. Contact the California Forestry Stewardship Program's Forestry Helpline at: 800-738-TREE (8733) or at forestryhelp@gmail.com for more information and a list of Registered Professional Foresters and Certified Arborists practicing in California.
- (3) Monitor and maintain any pre-existing and new fire/fuel breaks, access roads and trails that might exist on your property to make sure that surface runoff does not concentrate and cause these facilities to erode or cause damage to slopes, soils and water courses. Proper grading and/ or correctly spaced and constructed water bars and/or drainage/rolling dips will help to prevent these bare soil and disturbed areas from being an erosion problem during the rainy season.
 1. *Note: In some cases, water bars may actually cause problems if not located, constructed or maintained properly. In other cases, they might not even be needed. Bare and disturbed soil areas can also be protected with a layer of slash or weed-free straw mulch. Consult with NRCS and/or CalFire for assistance on preventing erosion on fire/fuel breaks and access routes constructed in the firefighting effort.*
- (4) Do not plant non-native erosion control seed mixes. These mixes are not intended for forestland. Where soil and sunlight conditions are desirable, some seeding of equipment/dozer disturbed areas (usually around home sites and not in the wildland landscape) may be beneficial but should only be done in accordance with appropriate native or short-lived, non-invasive, non-native grasses and advice provided by NRCS, fire restoration expert, or a CPESC.
 2. *Note: Seeding will delay native plant regeneration and actually compete with natural recovery of the forest landscape.*
- (5) Runoff control will be imperative in the first few winters following wildfire, especially where drainage facilities on roads and around structures were damaged, destroyed or inadequate. Efforts should be made to minimize concentrated flow especially over steep slopes. Whenever possible, runoff should not be channeled but allowed to either sheet over the soil and slopes as it naturally would or be

controlled in such a way that it does not cause slope saturation or erosion. Contact NRCS for runoff control strategies and further details.

- (6) Control non-native, invasive plants that will want to take over fire damaged soils and slopes following fire and in the years ahead. Non-native plants will slow natural regeneration and will likely create a higher fire and soil erosion hazard over time.

DO:

DO: Consult with the Natural Resources Conservation Service (NRCS) and your local Resource Conservation District (RCD) and/or a private land restoration consultant before starting any landscape, slope or soil restoration effort on areas damaged by wild fire.

DO: Gather as much information as possible from Cal Fire, U.S. Forest Service, local fire district officials, Fire Safe Councils, NRCS, RCD, and/or local fire restoration consultants regarding reducing fire hazard and making your property fire safe when planning your property restoration.

DO: Evaluate and map out locations of existing and/or pre-fire subsurface drainage, irrigation and utility facilities on your property, including under-ground pipe drains and outlets; roof runoff/gutter drain outlets; culverts; irrigation systems; utilities, etc. Determine if still operable and/or degree of damage, if any. *Note: Many underground plastic drains and irrigation lines may have melted or otherwise been destroyed in the fire or by fire-fighting equipment.*

DO: Install sediment control measures, such as straw wattles, mulching, plantings, slash, sediment traps and/ or other properly designed and located sediment control measures, if necessary, and as directed by NRCS, RCD or other resource restoration specialist, such as a Certified Professional in Erosion and Sediment Control (CPESC). *Note: Sediment control measures will help to prevent eroded and displaced soil from entering streams, roadside ditches and waterways, and help protect water quality and water supplies. Consult with licensed landscape contractors or other licensed contractors with erosion and sediment control experience for design and installation assistance.*

DO: Coordinate and plan restoration efforts with neighbors and/or road and neighborhood associations.

DO: Re-plant damaged landscapes with drought tolerant, fire retardant native plants with re-sprouting ability. Use planting stock and/or seed that are native to the area and is from a locally collected source. Consult with NRCS/RCD for a list of plants to consider.

DO: Obtain any necessary permits before cutting down trees, performing any major land grading activity, building any retaining wall, constructing a permanent sediment or erosion control structure, or doing any work in a riparian area, wetland, stream course or other natural area. *Note: Permits and/or consultations may be needed from your county office, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service,*

California Regional Water Quality Control Board, U.S. Army Corp of Engineers, and NOAA/National Marine Fisheries Service.

DO: Monitor and maintain fire and fuel breaks that may have been created by fire fighters on your property. Water bars/breaks should be provided and maintained on these fire control measures so that runoff water does not concentrate and cause erosion. Consult with CalFire regarding maintenance assistance of fire and fuel breaks constructed by fire fighters on your property during the Fire.

DO: Monitor and maintain all existing and planned erosion, sediment, and drainage control measures, including vegetative treatments, before during and after all future rainfall events. Correct deficiencies as soon as possible. *Note: One of the main reasons why recommended treatment practices fail following installation is the lack of long term maintenance by the landowner or responsible party.*

DO: *Hire and/or consult with licensed contractors, preferably ones that are certified and/or experience in soil erosion and sediment control, for design and installation assistance of vegetative and structural measures needed to restore slopes, soils, proper drainage conditions and landscape.*

DON'T

DON'T: Be too quick to remove fire damaged vegetation, including trees that were not completely burned. Many of the damaged and scorched native plants will re-sprout and come back, including oak trees that were severely burned. *Note: Consider pruning first before removing the entire plant.*

DON'T: Place loose debris, pruning's, discarded fire-damaged vegetation in gullies, drainage swales or watercourses, over stream banks, etc. in an attempt to protect bare soil without first consulting with NRCS. Piles of brush will prevent plants from reestablishing under dense brush piles and may dislodge if in contact with concentrated runoff or stream flows causing other problems. *Note: Removed brush can sometimes be used as mulch if chipped or spread thinly over the critical soil areas.*

DON'T: Plant Erosion Control Seed Mixes. These mixes are likely to contain non-native mix of grasses and legumes or California natives that are indigenous to other areas of the state and/or are not intended for wild land or fire damaged soil/slope restoration. Don't plant other non-native, invasive plants or grasses, such as annual rye-grass as well. *Note: In some situations bare and disturbed soil and slopes can be re-seeded/re-planted with native grasses and plants but only if the seed and plant materials are from local known sources and indigenous to the area that needs treatment. Other native grasses and plants may discourage local natives from reestablishing on their own, and/or compete with, and/or slow down native re-establishment. If white ash is present, then resident seed from pre-existing native plants may no longer exist. White ash is an indicator that the fire burned very hot. Any resident seed bank in the soil was likely killed during the fire in these white ash areas. Re-*

seeding these areas to native grasses and/or re-planting with native plants of the same genotype, according to a re-vegetation plan developed by an experienced fire ecologist/native plant specialist, may be a good idea.

DON'T: Use materials such as broken asphalt or concrete, inorganic debris or other objects as an emergency or permanent erosion control measure, especially if these materials can come in contact with runoff water, natural drainages and stream courses.

Note: In some cases, rock and broken concrete can be used as velocity dissipaters and placed at the outlets of road culverts or other drains to protect the soil from erosion and washout, provided these dissipaters are designed by an appropriate professional.

DON'T: Cover fire damaged slopes with plastic sheeting in an attempt to prevent slope failure and protect bare or disturbed soil from next year's rainfall. Plastic sheeting will: increase runoff and the likelihood of erosion; retain moisture in the ground increasing the possibility of slope saturation and instability; and kills root systems of native plants trying to re-establish naturally. Plastic sheeting is almost always the wrong thing to do.

Note: Depending on site conditions, an alternative to plastic sheeting might be the use of hydro-mulch, a proper application of rice straw, or an erosion control blanket if recommended by a Certified Professional Erosion and Sediment Control (CPESC) or geo-technical consultant.

DON'T: Control and concentrate future property drainage and runoff without a proper drainage control design that considers proper drainage facility sizing, location, and dispersion method. Whenever possible keep surface runoff in natural "sheet" flow and incorporate practices such as vegetative cover to slow runoff and improve the water infiltration capacity of the soil.

Note: Consult with NRCS/RCD for general planning information on controlling drainage around your home and property before proceeding with drainage repairs and improvements following fire damage. For design and installation assistance contact a landscape contractor experienced in erosion and drainage control.

DON'T: Use straw bales (in whole bale form) as water diversion and detention devices or for sediment control in burn areas. Contrary to popular belief and use these devices require a great deal of maintenance and are not right for most situations. Their design, location, and installation should only be done by a qualified contractor certified in erosion and sediment control. Straw wattles and loose straw that is simply spread over bare and disturbed soil is much more effective in protecting soil than keeping it in bale form.

Note: Rice or weed-free straw should only be used to prevent the possibility of nonnative grasses and weeds, contained in straw bales, from colonizing treatment areas.

DON'T: Disturb the hydrophobic soil layer that forms on some soils following fire on slopes susceptible to land sliding. Hydrophobicity is a natural phenomenon that actually gives the soil a water repellent ability that reduces infiltration and the capacity of the soil to hold water. The hydrophobic layer is normally found within 6 inches of the surface. In other areas, it may be advisable to break up this layer to aid in plant establishment and water infiltration lessening the impacts of runoff and erosion. For more information on soil hydrophobicity and/or an on-site soil evaluation and site assessment contact NRCS.

DON'T: Disturb potentially unstable slopes, especially those in fault areas and/or with signs of previous movement or known historic instability. Disturbances such as grading, cutting, removing trees root wads or other deep excavations will increase the likelihood of future slope failure. Note: If these slope alternations are absolutely necessary, then consult with a registered geologist or geo-technical expert before slope disturbance/restoration activity.

DON'T: Do anything. This may be the best solution on some properties. Doing nothing will allow nature and time to heal soil and vegetation damage naturally, especially in wild land and other natural areas. In fact, tampering with natural processes may very well delay natural recovery and re-establishment of pre-existing native cover. Note: Practices such as sandbags, plastic, straw bale basins and check dams, etc. are all temporary and require a great deal maintenance. Furthermore, they are not right for every situation and can actually make problems worse or create new ones.

DON'T: Wait until the last minute to plan, design and install erosion, sediment or drainage control practices that may be necessary to safeguard your home and property before next winter.

Note: The nature and extent of your restoration effort will depend on the degree of damage; time needed to get a site assessment; acquiring an appropriate plan and design; securing any necessary permits; lining up a contractor and doing the work.

HAZARD TREE REMOVAL

CAUTION: After a fire many trees are weakened from burning around the base of the trunk. The trees can fall over or blow down without warning. Shallow-rooted trees can also fall. Therefore be extremely alert when around burned trees.

What is hazard tree removal?

The work consists of removing dead and/or damaged trees that pose a hazard to people, animals, personal property, utilities, and other structures that might be damaged from falling trees.

When should trees be removed?

Work should be completed by qualified fallers and/or equipment operators. Inspect the tree prior to falling to identify any hazards such as cracks, mistletoe brooms or deformities in the bole or canopy that can increase the complexity of falling the tree. When cutting hazard trees, you should try to limit soil disturbance and the number of vehicular trips across your land. This will help to minimize erosion and noxious weed introduction. All branches should be cut from the tree and the trunk of tree should lay flat

How should trees be removed?

On the soil surface. Cut-tree material is often more valuable left on-site. Broadcasting chips from dead trees back onto the burned land can help reduce erosion. Log erosion barriers may help stabilize soils on slopes in some areas (see specification on Log Erosion Barriers). In addition, lopping and scattering limbs and finer

material can help reduce surface water flow, erosion and improve soil condition by replacing organic matter and nutrients.

Safety precautions

Removing hazardous trees in burned areas is dangerous due to a significant risk that burned trees may fall unexpectedly or drop branches on workers with little or no warning- especially during times of high winds, heavy precipitation and/or saturated soils. Always use the appropriate personal protection gear when operating a chainsaw, such as: hard hat, gloves, eye protection, hearing protection, chaps and steel toed boots. Use chainsaws with spark arresters and review their safety instructions. Review safety instructions when using ATVs or other machinery.

In the years following the fire, many of the trees will begin to fall on their own as roots, trunks and limbs decay. Landowners should continue to be aware of these hazards.

EROSION CONTROL MATS

CAUTION: After a fire many trees are weakened from burning around the base of the trunk. The trees can fall over or blow down without warning. Shallow-rooted trees can also fall. Therefore be extremely alert when around burned trees.

What are erosion control mats?

An erosion control mat (ECM) is a protective mulch blanket or soil stabilization mat constructed with Rolled Erosion Control Product (RECP). The ECM is anchored on a slope to limit erosion from rainfall or overland flow, or to enhance revegetation. The RECP can be as simple as fiber (jute or coir) or synthetic netting staked down over straw mulch; or as complex as a multi-layer geosynthetic composite blanket.

When are erosion control mats used?

ECMs are used on severely burned slopes that have lost protective vegetative cover. ECMs are expensive so their use is generally limited to small areas to prevent erosion that would otherwise cause significant damage to high value properties. ECMs can be used in conjunction with or as an alternative to mulches. ECMs are not appropriate in all situations.

ECMs are not recommended for steep slopes with sandy soils, or slopes with many rocks on the surface, or for slopes with a significant amount of fire burned vegetation remaining. The ground surface must be fairly smooth, and such obstructions would prevent good contact between the ECM and the soil.

How are erosion control mats installed?

The soil surface should be reasonably smooth. Rocks and other obstructions which rise above the level of the soil and mulch must be removed.

The chosen RECP should be applied up and down the slope - never along the contour. The upper end of the roll at the top of the treated area should be buried in a trench at least 8 inches deep. Rolls should be laid out so that edges overlap each other by at least 6 inches across the slope. When more than one roll is required going down the slope. The ends going down the slope should overlap by at least 3 feet. This is extremely important!

Anchor pins or staples are used to anchor the netting to the soil surface. Anchor pins are made of rigid 0.12 inch diameter or heavier galvanized wire with a minimum length of 10 inches for hook or "J" type pins. Staples should be of wire .09 inches in diameter or greater and should have "U" shaped legs that are at least 6 inches in length. Longer staples are needed for sandy soils.

Staples or anchor pins need to be driven perpendicularly into the slope face and should be spaced about 5 feet apart down the sides and center of the roll. Spacing between staples at the upper end of a roll, and at the end overlap of two, rolls should not be greater than 1 foot.

SEEDING

Why seed after a wildfire?

Loss of vegetation leaves land vulnerable to increased runoff, erosion, and sedimentation. It also encourages weeds; degrades habitat; and impairs forest regeneration. Re-establishment of permanent vegetation provides long-term erosion control, may restore lost habitat values, and may help suppress noxious weed invasion after a wildfire. However it takes time and favorable climatic conditions to establish vegetation from seeding operations. Therefore it may be six months or a year before the full benefits of seeding are realized. Seeding must be combined with other land treatments, such as mulching, to provide an immediate erosion control benefit, and to assure the seed remains in place until it can germinate.

When is the right time to seed after a fire?

Seed grasses and forbs in late fall or winter (even if there are a few inches of snow). To improve the probability for a successful seeding, use a national or local weather services to time your seeding within 30 days of precipitation. The prime time to seed is immediately prior to the ground freezing. Trees or shrubs should be planted in the fall or early spring when plants are dormant.

What areas need to be seeded?

Severely burned sites should be seeded to decrease the likelihood of erosion and sediment movement down slopes, to discourage weed invasion, or to fulfill management objectives. The area to be seeded should have adequate soil to support vegetation. Seeding slopes steeper than 60 percent is difficult, and not especially effective for reestablishing permanent vegetation. These steep slopes may need the use of erosion control mats to keep soil and seed in place. These mats are expensive so use only on critical areas. Vegetation in areas of light and moderate burn severity will recover on its own after a wildfire, and seeding perennial species is usually not necessary. Seeding a temporary species may provide some ground cover or reduce intrusion of weeds until the permanent vegetation can reestablish.

How should the seeding be done?

Most seeding are done by hand, use of self-propelled ground equipment, or by aircraft. Landowners can seed small areas using a hand-crank seed broadcaster. If there is access to the site and the slope is less than about 30 percent it is usually easier and more cost effective to seed areas larger than about 1-2 acres with broadcast seeders mounted on all terrain vehicles or tractors. Large contiguous areas lend themselves to aerial seeding, which can also be used on slopes that are too steep or otherwise inaccessible for use of ground equipment. Seeding included with a hydromulching operation should be considered when re-vegetation is essential to protecting high value properties immediately downstream of the area being treated. If fire seals or rain smooths soil surface, then it may be helpful for small areas to rake by hand and for larger areas to roughen up the surface mechanically (see Mechanical Scarification) prior to broadcast seeding, for improved success.

What variety of seeds should be used?

Perennial grasses and forbs are slower to establish, but provide long-term cover for reseeded sites. For example, slender wheatgrass is a native grass that establishes quickly and is moderately long-lived. Over time, as the slender wheatgrass begins to die out, other native species begin to fill in the site. Small grains are useful when quick establishment is key; however, they only provide one year of protection. Revegetate with annual species where perennial grasses will recover naturally, including moderately burned sites with slopes greater than 15 percent. For severely burned areas it would be appropriate to include perennial species with the small annual grains. You should use certified seed of a known variety to get the best results. If a specified variety is not available, be sure the original seed (germplasm) source is within 200 miles north/south; 500 miles east/west; and 3,000 feet elevation of your property. Be sure seed does not contain any noxious weeds.

Most seeding recommendations are seed drilling rates expressed in terms of pounds of pure live seed (PLS) per acre ($PLS = \%Purity \times \%Germination$). Broadcast rates for burned areas should be at least double the drilling rates.

Hydromulching

What is hydromulching?

Hydromulching is spraying a mixture of water, fiber mulch, and tackifier on burned slopes to prevent soil erosion or foster revegetation. Seed, fertilizer, or soil stabilizing polymers may also be applied with the hydromulch.

When is hydromulching used?

Hydromulch is used on severely burned or otherwise highly erosive areas with 20 percent to 60 percent slopes. Hydromulching is an expensive erosion control method and therefore is generally limited to treating high risk areas to protect valuable properties, surface water supply sources, or important habitat. Due to its expense,

conventional mulching is generally used on slopes less than 20 percent. Use of ground applied hydromulch is limited to areas within 300 feet of the roads or trails that are necessary to provide access for the application equipment.

Uniform aerial application of hydromulch is difficult to accomplish and as a result has proven less effective for erosion control, so it is seldom recommended. Hydromulch is generally not recommended where there is more than 25 percent surface rock cover, in areas where there is appreciable needle-cast, or where there is good potential for regrowth of vegetation within the first year after a fire.

Methods and Materials:

Hydromulching utilizes a 1,000 to 3,000 gallon tank mounted on a truck or trailer that is equipped with a special pump and continuous agitation system. The pump forces the slurry through either a discharge nozzle mounted on top of the tank or a nozzle on the end of a hose. Hoses are typically limited to 200 feet in length. Fiber mulch and tackifier are added to the water in the tank and thoroughly mixed prior to application.

The type and amount of mulch and tackifier is selected to provide a minimum of 70 percent surface cover that will remain in place for at least one growing season. Application rates in the range of 2,000 to 3,000 pounds of wood fiber mulch and 75 to 100 pounds of Guar based tackifier per acre are typical. Fiber mulch has natural tackifying properties, but adding a tackifier is necessary to ensure the mulch remains in place when it is applied to burned slopes. Use of 500 to 1,000 pounds fiber mulch per acre and tackifier can be applied over loose, blown straw to tack it down where crimping is impractical.

The actual materials and application rates to be used at any location should be determined by erosion control experts with consideration for the specific site characteristics and the level of protection required.

Hydroseeding:

When seed is applied with the mulch (Hydroseeding) split applications are generally more effective than applying all materials in one pass. About 500 pounds of mulch per acre is applied with the seed (and fertilizer if recommended) in the first pass followed by a second application of 1,500 to 2,000 pounds of mulch and tackifier.

Safety concerns:

Ground hydromulching uses existing roads that may have other traffic. A road safety plan is needed to identify and explain how to mitigate traffic related hazards.

Personnel applying hydromulch must wear the type and extent of personnel protective equipment that is appropriate for the type and nature of material being applied.

Fiber mulch is dyed to aid in uniform distribution, and care should be taken to avoid application on concrete, painted surfaces, or other structures/areas where mulch is not intended to be applied.

After the Fire: Resources for Ranchers

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Introduction

Annual grasslands and oak woodlands in the Sacramento Valley and Sierra foothills are prone to fire. Ranchers and rangeland managers should consider steps that will protect soil resources, restore forage productivity, and reduce the establishment of invasive weeds after wildfire. Specific practices depend on landowner/manager goals. This publication summarizes current research regarding post-fire restoration.

Protecting Soil Resources

Preventing soil erosion is a top priority for fire-impacted rangelands. Physical changes to the soil, combined with loss of vegetation, can create a variety of problems including soil movement, increased runoff, mudflows, and debris flows. Research indicates that the amount of exposed mineral soil, regardless of slope, is correlated to erosion potential. For rangeland livestock operations, weed-free straw mulch is the best option for keeping soil in place. Soil protection measures should be in place before the first significant rain of the autumn.

Re-seeding Rangelands

Re-seeding strategies depend largely on landowner goals. For example, ranchers who wish to re-establish forage for livestock will have different objectives than landowners who wish to restore native grasslands or provide pollinator habitat. While native grass and forb species can maintain forage quality longer into the growing season, these species can take longer to become established. Conversely, non-native forage species can become established rapidly, providing both soil protection and forage for livestock in the following spring.

Re-seeding Considerations

Try to plant seed during or just prior to the onset of fall rain.

Consider applying mulch after seeding to prevent erosion. Weed-free rice straw bales applied at a rate of approximately 40 bales to the acre can protect soil.

Plant multiple species to provide diversity and maximize ecosystem services (like soil protection, water infiltration and nitrogen fixation).

If rangelands will be grazed, include at least 20% legumes in the seed mix.

Seeding rates depend on species and on application system.

Broadcast seeding (by hand or by aerial application) requires more seed than other approaches. Soil preparation (disking or harrowing) and post-seeding imprinting may be necessary to ensure seed-to-soil contact necessary for germination. No-till drill seeding can promote more ideal conditions for germination and typically requires a lower seeding rate. However, drill seeding can be cost prohibitive on a large scale.

Hydroseeding, while more costly, helps keep soil and seeds in place.

Grazing can typically resume in the spring once plants are reestablished. If perennial grasses and forbs have been planted, grazing may need to be deferred longer to allow for establishment.

Seeding Recommendations

The appropriate seed mix depends on site-specific goals and conditions. Similarly, seeding rates depending on planting method and conditions. For site-specific recommendations, contact your local USDA Natural Resource Conservation Service office.

Log Erosion Barriers

What are Log Erosion Barriers?

Log Erosion Barriers (LEBs) are logs placed in a shallow trench on the contour to intercept water running down a slope and trap sediment. This treatment may also be known as contour log felling, log terraces or terracettes.

When are log erosion barriers used?

Log erosion barriers are used on moderate or severely burned slopes ranging between 20 percent to 60 percent, with erosive soils. LEBs are used where erosion rates have increased significantly because of the fire and there are high values at risk downstream. The site must have enough trees of adequate size to meet treatment objectives (at least 60 trees per acre). Soils can be shallow, but not less than about 8 inches. LEBs increase infiltration, add roughness, reduce erosion, and help retain small amounts of eroded soil on site. LEBs should be effective for a period of one to two years, providing short-term protection on slopes where permanent vegetation will re-establish and provides long-term erosion control.

Materials needed:

6-12 inch diameter logs, 10-30 feet long

An expert sawyer and labor crew with hand tools

Machines may be used for moving logs or trenching them in on 30 percent or flatter slopes

How are log erosion barriers installed?

A contour line is marked on the slope to identify the approximate cross slope alignment. Trees along this line are felled on the upstream side of the contour line as much as possible. Stumps are left about 12" high to brace the tree. The logs are cut to a length that permits safe handling and placement for the crew, generally 10 to 30 feet. Tree limbs are removed to the extent necessary for the log to lie flat on the ground. A shallow trench (about 4 to 6 inches deep) is dug along the contour. The log is placed in the trench and seated with tamped backfill such that water flowing down the slope will not run under it. For this practice to be effective, enough trees must be felled along the contour line to create a semi continuous barrier to the movement of water down the slope, as shown in Figure 1 & 2.

Hillside Home Drainage

Drainage tips for hillside homeowners:

Hillside lots that have been damaged by fire or are located in a fire-damaged watershed can be susceptible to erosion, drainage and other runoff related problems. Torrential or prolonged rains cause the most damage. To treat surface drainage problems, you will first need to identify the sources of surface water (runoff) flowing onto or over your property. Walk outside and around your home. As you walk, observe the “lay” of your lot and the surrounding properties. Also, observe your roof and driveway. Is your home on top of a hill where all surface waters drain away from your home? If so, you will be concerned with holding topsoil on your property. Few homeowners live on top of a hill. So, it is more likely that water will flow onto your property from an adjacent hillside. Where will the water concentrate and how can you control the sediment that is carried with the water?

Gutters and down-spouts direct roof runoff:

Be sure that your roof is properly fitted with gutters and downspouts that will release water onto a non-erodible surface such as a paved driveway. Or you can connect downspouts firmly to solid plastic pipe that will carry water down slope away from your home to a place where it will be released safely such as a paved roadside or storm drain ditch. Because twigs, pine needles and leaves can clog gutters and downspouts, the use of gutter guards of 1/4 to 1/2-inch hardware cloth screen is highly recommended. Clear your gutters regularly and inspect them to ensure your roof runoff system is working properly.

Curbs and berms protect sensitive slopes:

A concrete curb, a compacted earth berm, or other similar structures on the outside edge of a driveway or building pad can direct runoff away from sensitive slopes to an area where it can be released safely. The recommended height of the berm is a minimum of 12-18 inches. (see other fact sheets for information on temporary flood barriers). A pipe drop may be used to carry runoff down slope to a place where it can be released safely, such as a lined roadside ditch or storm drain.

Lined ditches handle road & driveway runoff:

Roads and driveways can be graded toward a lined ditch or street side gutter designed to handle sheet flow water from paved surfaces and uphill slopes. At specific intervals along the main road, water may be transported under the road through a culvert and released safely onto a non-erodible surface. An energy dissipater, such as a rock lined outlet, can serve this purpose where slope is minimal. In steeper areas or where large volumes of water may accumulate, other precautions may be needed to prevent wash-outs or localized flooding.

Proper grading promotes good drainage:

Proper grading of your land helps prevent water from pooling around foundations, flooding basements or below grade structural components, and concentrating water into destructive volumes. In general, grade surfaces around a home so runoff flows away from foundations at a minimum slope of 1-2 feet for every 100 feet. Grade and compact surfaces evenly since water can collect in depressions or channelize into destructive flows.

HILLSLOPE TREATMENT

Effectiveness and Performance Characteristics Summary

This synthesis of post-fire treatment effectiveness reviews post-fire hillslope emergency stabilization treatment research and monitoring with an emphasis on the past decade. Since 2000, erosion barrier treatments (contour-felled logs, straw wattles), which were a mainstay of post-fire management prior to 2000, have declined in use for hillslope stabilization. **At the same time, mulching treatments are increasingly being applied when values-at-risk warrant protection.**

This change has been motivated by research that shows the proportion of exposed mineral soil (or, conversely, the proportion of ground cover) to be the primary factor in the amount of post-fire hillslope erosion. Erosion barrier treatments provide little ground cover and have been shown to be less effective than mulch, especially during short-duration high-intensity rainfall events. Innovative options for producing and applying mulch materials have made it possible to apply ground cover over large burned areas that are inaccessible by road. Although longer-term studies on mulch treatment effectiveness are still on-going, early results and short-term studies have shown dry mulches (agricultural straw, wood chips, wood shreds, etc.) to be highly effective post-fire hillslope stabilization treatments. Consequently, mulch treatments have become common-place in the post-fire environment to provide protection to high values-at-risk. Hydromulches, and to a lesser degree, soil binding chemical treatments, have been used after some fires but these treatments have been less effective than dry mulches in stabilizing burned hillslopes and generally decompose or degrade within a year.

Preparing for Winter Following Fire in Vineyards, Orchards, and Rangelands

The sound of falling rain this winter may take on a whole new meaning for those who either suffered property damage from wildfires or who live directly downstream of fire damaged watersheds.

If you have an existing Napa County-approved Erosion Control Plan (ECP) for your vineyard, a Sonoma County-approved Vineyard and Orchard Site Development Ordinance (VESCO) permit for your orchard or vineyard, or a Ranch Water Quality Plan (RWQP) for your grazed land in the Sonoma Creek or Napa River watershed, follow it. Further guidance may be found in Sonoma County's Best Management Practices for Agricultural Erosion and Sediment Control and the Napa County Code (Chapter 18.108, Conservation Regulations).

If you don't have one of the above plans and/or are concerned about the possibility of erosion, mudslides, flooding, or other winter storm impacts following fire, then these 10 Basic Rules may help you prepare your property and family for future winter storm runoff.

Cover disturbed areas. Protect remaining plant cover. Spread mulch (straw, wood chips, etc.) and establish vegetation by seeding bare or disturbed soils before winter rains, especially around buildings, structures, firebreaks, and access roads and driveways. Seed mixtures should either be native or, if non-native, should be non-invasive species. Note: seeding and mulching is generally not recommended in rangeland and wildland areas.

Prevent soil disturbance. Minimize travel on, and tillage of, burned areas during the rainy Season. Slopes are less stable, and soils are more erodible, when vegetation is burned, soil has been impacted by heat, a _____?

Evaluate roads and drainage facilities. Look for damage on earthen and gravel roads, firebreaks, culverts, and stream crossings. Runoff control treatments, including armored outlets, may be needed to protect downslope areas from erosion, slope failure, and flood hazards. Use the “4-D formula” to:

- A. Decrease volumes and/or velocity of runoff by providing energy dissipation (rock or other armoring) at culvert and drain outlets and dividing large flows from roofs and landscapes into smaller, less erosive forms.
- B. Detain or collect runoff and either release it over time or store it for later use to lessen impact on saturated soils and slopes during large storms.
- C. Dissipate runoff where ever concentrated flows come in contact with bare soil and/or steep slopes by installing practices that spread runoff at culvert and drain outlets if they have been denuded by fire. Divert runoff as a last resort and do so with extreme caution. It may be helpful to re-route runoff and drainage away from unstable slopes, eroded areas, or unprotected soils.

Monitor and maintain existing measures. Check existing erosion and sediment control structures and treatments (including vegetative cover) before and throughout the rainy season. Correct deficiencies as soon as possible. Leaf litter may clog roof, driveway, and surface drainage systems because of the fire and heat damage done to evergreen vegetation. Properly designed and installed trash racks, debris barriers, gutter guards, and other devices will reduce maintenance and allow home and property drainage systems to function properly.

Use caution with emergency treatments. Use caution when employing sand bags, brush and slash, plastic sheeting, and hand-dug drainage ditches, or don't use them at all without professional guidance. For example, covering slopes with plastic sheeting can speed up rainfall runoff and dumping brush into gullies may clog downstream drainage structures. An improperly designed or placed emergency practice can be worse than not doing anything at all, adding new hazards and a false sense of security.

Treat high hazard, fire damaged trees. Prune or remove trees that may fall onto people, animals, structures, or roadways before winter storms. Note: don' remove healthy or slightly damaged trees unnecessarily. Healthy tree root systems still hold soil and slopes in place and the tree canopy protects soil from the impact of falling raindrops while reducing winter runoff. Consult Cal Fire and/or a Registered Professional Forester for assistance.

Consider debris barriers below rocky slopes. There is an increased threat of falling rocks from steep slopes and shallow, rocky soils in affected watersheds. Debris barriers are effective for catching smaller rocks, but larger rocks will require more substantial measures. If there is a threat of large rocks releasing from slopes on your property or adjacent properties, then seek professional assistance. Contact the USDA Natural Resources Conservation Service (NRCS) or your local Resource Conservation District (RCD).

Seek professional assistance. For the design and installation of any temporary or permanent practices to control runoff and/or prevent erosion, services from NRCS and RCDs are here for you. www.ca.nrcs.usda.gov.

Work with neighbors. Permanent solutions for drainage and runoff issues may be better with the cooperation of neighboring landowners since runoff rarely follows property boundaries. You may be liable for both controlled and uncontrolled releases of collected runoff on to downslope properties if you do not consider potential off-site impacts.

Be prepared with an evacuation plan. Don't stay if it becomes unsafe to do so. Prepare a property and neighborhood evacuation plan and an emergency plan for pets and livestock. Stockpile emergency supplies including sandbags, straw mulch, etc. Pay close attention to weather forecasts, flash flood and storm warnings, and creek water levels throughout the winter. Evacuation plans should include at least one alternative escape route and a list of emergency phone numbers, including those of neighbors.

Roadblocks, flooding, gullies and stream bank erosion are often worse in the first winter following fire. Sediment levels in creeks and waterways are expected to rise, reducing channel flow capacities and increasing the likelihood of flooding on properties and downstream. Note: do not attempt to drive through flowing water or mud on roads.

Some signs of impending danger from debris flows, landslides, severe erosion, and/or imminent flooding include: an intense storm event (1" to 2" per hour) especially following recent rainfall; water flowing over the landscape where it hadn't appeared in previous winters; leaning or falling trees; tension cracks along the top edge of slopes and along driveways and roads; seeps and increased spring activity in slopes; severely disturbed and unprotected slopes caused by firefighting work or from recent removal o

f fire damaged trees or other stabilizing vegetation.

For more information, helpful publications, erosion control plant lists for fire-prone areas, drainage control and road maintenance guides, or other natural resource information for your property, contact the USDA Natural Resources Conservation Service or your local Resource Conservation District.

C O U N T Y O F N E V A D A

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ADJUSTING PROPERTY TAXES FOR CALAMITIES

California's property tax laws provide a mechanism for the Assessor to adjust assessed values to recognize destruction caused by a calamity or misfortune which damages real or personal property. To qualify for a calamity adjustment the property must have suffered more than \$10,000 worth of damage and the owner must file a claim form with the Assessor within 12 months of the date of the calamity. Calamities do not include damage which occurs over time such as termite damage or gradual earth movements. There are slightly different rules that apply depending on whether the damage is caused by a widespread event that results in a Governor's proclamation of disaster or by a property-specific misfortune.

The value is reduced or removed during the time the property is in a state of disrepair and then reinstated when the property is repaired. If the structure is restored to its original condition, the original Proposition 13 base year value is enrolled plus the appropriate time factor. If a better quality or larger structure is built as a replacement, credit is given for the base year value of the original improvement and then additional value is added for the current market value of the upgraded or larger structure. In the case of a destroyed manufactured home installed before 1980 which was paying a registration fee to Sacramento, the replacement home will go on the property tax rolls but the value will be enrolled so that the property taxes do not exceed the amount of the prior registration fee.

Owners of properties who suffered qualifying damage in the October 2017 McCourtney, Lobo or Garden fires can also apply to delay the payment of the December 11, 2017 first installment of their 2017-2018 property tax bill. An application for deferral must be submitted with the calamity reassessment claim no later than December 11, 2017. Taxes would be deferred until 30 days following the receipt of a corrected bill that reflects the temporary reduction in value caused by the fires.

Should you have any questions, please contact
Nevada County Assessor Sue Horne at 530-265-1232
or by e-mail at assessor@co.nevada.ca.us

After the Fire

Tips for Rangeland Managers

By Dr. Kate Wilkin, Forestry/Fire Science and Natural

Resource Advisor and Dan Macon, Livestock and

Natural Resource Advisor

Like many Northern Californians, we awoke early on October 9, 2017, to reports of wind-driven wildfires devastating our communities. At this writing, fire crews continue to fight the Lobo and McCourtney Fires in Nevada County, the Cascade Fire in Yuba County and the La Porte and Cherokee Fires in Butte County. As we begin to think about the long road to recovering from these fires, we wanted to provide some resources for rangeland owners and managers to assist with post-fire recovery activities.

It might be hard to look out at the charred landscape and imagine its recovery now. However, within the month, we will start to see green growth. Riparian areas will start to green-up within the next two to six weeks. Even

though many of the oaks may appear dead, many will sprout from the base this growing season. For surviving oaks, their canopies most often recover within three growing seasons. While the thin-barked foothill pines may not survive, many of our native shrub species will re-sprout or reseed.

To start the recovery, you will need to assess the fire severity on your property, and any nearby values that you would like to maintain. Many of us in the foothills are concerned about the oaks that have been damaged by fire. A 2011 publication from the University of California provides important information about managing burned oaks. Go to <http://anrcatalog.ucanr.edu/pdf/8445.pdf> to download the publication. Authors Doug McCreary and Glenn Nader provide guidelines for determining which fire-damaged oaks on your land may survive. Trees on which the cambium layer (the tissue directly beneath the bark) has been killed all the way around the stem will eventually die. However, McCreary and Nader write, even if a small portion of the circumference of the cambium remains alive (as little as 10%), the tree will likely survive. Generally, trees that suffer leaf damage will recover if the cambium survives. The publication offers the following guidelines for deciding which trees to leave:

Finally, even killed trees that have been cut down may re-sprout. Live oak re-sprouts can be especially vigorous, but almost all other oak species will sprout in the following spring. If sprouts are pruned back to one or two dominant shoots, these will grow more rapidly and have less tendency to develop multiple trunks.

As we head into the rainy season, preventing soil erosion is also a priority on fire-impacted landscapes. There are several methods landowners should consider for preventing erosion after a fire. Mulch, like certified weed-free straw, can be used to cover bare soils. This reduces raindrop impact and soil particle movement and can offset the effects of water-repellent soils. On steeper slopes, straw wattles, silt fences, log barriers or straw bale check dams can slow water flow, trap sediment and increase infiltration. Depending on your landscape and livestock operation, you may want to reseed annual grasslands this fall as well – the Natural Resources Conservation Service (NRCS) should have seeding recommendations. On the other hand, natural regeneration of the vegetation may be preferable for some landowners and on some landscapes. A new publication on restoring annual grassland systems has useful information on this subject (see <http://anrcatalog.ucanr.edu/pdf/8575.pdf>). In addition, NRCS has a variety of cost-share and technical assistance programs that may help landowners address post-fire erosion and re-vegetation concerns.

The USDA Farm Service Agency has several programs available to assist livestock producers who have lost forage to wildfire. The Emergency Assistance for Livestock, Honeybees and Farm-Raised Fish Program (ELAP) can provide some reimbursement for livestock death losses and forage losses – download this fact sheet for more information: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2017/elap_for_livestock_oct2017.pdf.

Finally, ranchers should watch for smoke and fire-induced stress impacts on livestock. Just as with humans, smoke inhalation can cause irritation of the eyes and respiratory tract in livestock. It can also aggravate chronic lung diseases and reduce lung function. Burn injuries can also be an issue for some producers. Drs. John Madigan, David Wilson and Carolyn Stull from the UC Davis School of Veterinary Medicine have developed a short, easy-to-read publication on caring for livestock after a wildfire download the publication here: <http://cecentralsierra.ucanr.edu/files/220420.pdf>.

Okay to Cut Trees that:

Are less than 6 inches in diameter and have been scorched all the way around the trunk

Are 6-12 inches in diameter and have continuous charring around the base, with reductions in bark thickness

Are more than 12 inches in diameter and have continuous charring, pronounced reductions bark thickness and have occasional exposure of underlying wood.

Have basal wounds on 50% or more of their trunks and are located where they could present a safety hazard

We should note that while these trees are dead, they do not necessarily present a safety hazard.

Leave Trees that:

Have lost most of their leaves but have sustained only minor stem damage.

Have only spotty scorching on the trunk, with at least 10% of the cambium alive.

Are over 12 inches in diameter and are scorched all the way around the trunk but with no reduction in bark thickness.

Recovering from fire is a long, challenging process. In the upcoming weeks, we will write more about prioritizing vegetation management and post-fire succession on your property. In the meantime, be sure to check out the Sutter-Yuba Living with Fire Webpage at http://cesutter.ucanr.edu/Fire_Information/. If you have specific questions regarding fire impacts and post-fire recovery on your property, don't hesitate to contact us directly!

Use of Natives in Annual Dominated Systems in Central California

In general, the establishment of California natives in exotic annual dominated systems involves a number of key steps for success. The re-establishment process includes: (1) waiting for annual grass weeds to emerge approximately 5-7 days after the first fall rains, and then managing them either with an herbicide or mechanical treatment. Keep in mind that the plants that colonize after a fire can often be invasive forbs – particularly yellow starthistle – and are not necessarily the types of plants that typically dominate annual grasslands; (2) soon after the “treatment”, planting re-vegetation species as seeds or plugs. It is important to choose species based on how well they will accommodate your management goals; (3) in late winter applying some kind of broadleaf weed management and, in early spring, managing grass weeds (with mowing or grazing) while your seeded species are still relatively small. Exotic annual grasses establish quickly and grow rapidly. Targeting them in early spring with mowing or grazing can reduce their ability to out-compete the desirable species. The choice of what to plant after a fire is as important as understanding the role fire plays in species selection. For example, generally, herbs tend to do better after a burn; however, they also tend to respond less well than grasses to grazing.

Management goals can include increasing forage production, erosion control and enhancing wildlife habitat. Regardless of restoration goal, multiple species should always be used in seeding or planting approaches because it increases resistance to further invasion by weedy plants.

Plant materials used should be adapted to local conditions. The easiest way to acquire suitable plant materials for re-vegetation is from local or federal native nurseries and farms. You can check out the CA native plant link exchange for lists of seed and stock by county and producer: <http://cnplx.info> or look into the native seed network for resources on the native seed industry by state: <http://nativeseednetwork.org>. Although restoration seed mixes should be comprised of functionally dissimilar species (annuals and perennials, forbs and grasses, etc.), mixing annuals (which tend to grow quickly, bloom early, and have shallower roots) and perennials (which tend to grow slowly, bloom late, and have deep roots) in seed mixes can result in a significant decrease of emerging perennials. Planting or seeding perennials earlier than annuals is a good way to encourage germination and root development of perennials in the absence of intense competitive pressure from annuals.

The establishment stage of seeded natives is extremely vulnerable to the competitive effects of invasive plants, therefore, after the majority of seeding and planting has been conducted, weed management must be maintained to ensure adequate establishment and survival of seeded species. In general, you should plan for a minimum of three years of subsequent weed management.