

## 8. USE OF FIRE

Fire is used in many ways and for various purposes related to industrial operations in the wildland. In some situations, it is the only practical solution to a problem. In others, it is the worst possible alternative. In the eyes of some, it is a natural process and always preferable to the use of any herbicide. To others, it poses an unacceptable threat of escape and destruction. In some cases, mechanical alternatives are available. In others, the only alternative is excessively expensive hand labor or collection and removal.

Fire is a very useful tool for the wildland fire management officer, land manager or construction contractor. It is also a very dangerous tool which should only be used by a well trained and experienced professional and with the full prior knowledge and permit approval of the responsible fire protection agency.

### 8.1 Slash Burning

- *PRC §4423 (Burn permits required)*
- *PRC §4425 (Violation of burn permits)*
- *36CFR §261.52k (Violating state law relating to burn permits that threaten National Forest land)*

Before any kind of burning can be done on commercial or private projects, local fire agencies need to issue appropriate burn permits and educate contractors, or private land owners, about air quality regulations and permits.

Logging slash is commonly burned for two reasons. One reason is to abate the greatly increased fire hazard of untreated slash. The other reason is to uncover the soil in preparation for planting or seeding to secure regeneration. Sometimes the slash is piled or wind-rowed before burning. On very steep slopes this pretreatment becomes difficult and expensive. Also, broadcast burns are more common.

Whether the slash is pretreated or broadcast burned there is usually an abundance of cull logs, large limbs and other heavy fuel. Most often there is plenty of fine and medium fuel to ignite this heavy fuel which then retains heat for long periods of time. Rekindled and escaped fires after two to six months, even after heavy rains and snows, are not at all uncommon.

One solution to this problem is yarding unmerchantable material (YUM logging) prior to burning. In the past, this material really was unmerchantable and only public agencies could afford to do it. With the interest in biomass fuel sources this situation may very well change and cause YUM logging to be economically practical. If so, slash burning is most likely to become a much safer operation.

Not all slash burning escapes result from holdovers in heavy fuels. Many of them are almost immediate and are generally the result of inadequate planning, preparation, staffing and/or execution. Logging slash creates a high intensity fire, which can easily escape by radiation, flying firebrands, or convection.

Proper planning includes keeping the size of individual plots to those which can be safely burned by the available staffing in one day. It also includes scheduling the burning of multiple plots over several days or weeks so that too many are not ignited on any given day. In many areas, because of the short interval between the end of fire season and the onset of heavy rains and/or snow, this is not considered practical.

This problem can be overcome by the use of a combustion-enhancing oxidizer fuel formulation developed by scientists at the Jet Propulsion Laboratory and California Institute of Technology in Pasadena (Combustion Science and Technology, 1977, Vol. 17, pp. 79-81). With this mixture plots can be burned at times when surrounding forest fuels are nonflammable. Planning should also include the provision of alternate work for the burning crews on days when weather or other conditions make burning difficult, impossible or unwise.

Preparation for a burn should include construction of adequate control lines, pretreatment (e.g., crushing, lopping, or spraying), and logistics (e.g., manpower, equipment, tools, ignition devices, water, and food). It is not a simple, nor a cheap undertaking.

Staffing involves more than someone to walk around with a fusee or drip torch. Adequate personnel should be present to keep the fire contained within its intended boundaries if it should flare up or make a sudden run. This includes detecting and suppressing spot fires outside the perimeter. In addition to foot troops, this will often require bulldozer or pump operators and other specialized personnel.

The most important position is an overall supervisor or prescribed fire manager to direct both the firing operation and any suppression action that may become necessary. The second most important staffing requirement is someone to patrol and, if necessary, mop up the burned plot until the fire is completely extinguished. As discussed above, this may extend into several months with daily patrols checking for hotspots.

Proper execution of a slash burn involves a thorough understanding of fire behavior, including the effects of topography, local wind patterns, fuel types and densities, etc. Generally, firing should proceed from uphill and downwind toward downhill and upwind. However, this pattern may have to be altered due to local conditions. In any event, firing should always be conducted so that no more heat is built up than can be safely contained by the standby suppression forces. This also prevents excessive amounts of smoke from being borne downwind to populated areas.



**Photograph 8-1.  
Slash Burn**

Where fuel loading is particularly heavy, or very strong or gusty winds are common, serious consideration should be given to mechanical alternatives to slash burning. Several of these have been developed; some especially for forest use, some originally for brush treatment, and some for use anywhere.

The Hydro-Ax should be able to convert either slash or standing trees up to 16 inches in diameter into chip mulch. Several brands of portable chippers will accept woody material up to four inches in diameter and blow the chips onto the forest floor. Other brush cutting machinery will chop material into small pieces and mix them into the top layer of soil. Machines which can effectively treat logging slash are either currently available or under development.



**Photograph 8-2.  
Chip Harvester**

## 8.2 Land Management Burning

- *PRC §4423 (Burn permits required)*
- *PRC §4425 (Violation of burn permits)*
- *36CFR §261.52k (Violating state law relating to burn permits that threaten NF land)*

Fire is also extensively used as a land management tool. One of the most common of these uses is for cover type conversion (e.g., brush to forest or range). Another is to reduce fire hazard by removing dead material, brush, or under-story trees. Still another is to favor one species or type of vegetation over another without changing the cover type.

In the past, such activities in California, and elsewhere in the West, were accomplished mainly by so-called “controlled burning.” Primarily this involved putting a control line around the area to be burned, waiting for a hot dry day without too much wind, and setting the area on fire. Sometimes the objective was accomplished. Often, not. Usually one or more escapes occurred, sometimes exceeding the planned area in size.

Some years ago the concept of burning in accordance with a prescription to achieve a specific goal on a particular site was developed in the South. In recent years prescribed burning has been accepted in the West and is a science. This type of burning involves a four-step process:

1. establishing the object;
2. taking fuel inventories (i.e., amount, size, type, distribution, etc.);
3. establishing the intensity of fire needed to obtain the objective in the existing fuels;  
and,
4. prescribing the range of weather factors that will produce the desired result on the type of topography where the site is located.

While writing the prescription requires knowledge and skill in the fields of fire physics and plant physiology, the execution of it demands similar knowledge and skill in fire behavior and meteorology. Firing too fast or too slow cannot only negate the objective but also cause an escape. Precise knowledge of local weather patterns is required to know when the prescribed conditions will exist, their duration, and in what ways they will change. The logistics involved can be complicated. Alternate work should be available for the crew in case the prescribed conditions do not develop on the scheduled day of the burn.

### **8.3 Debris Burning**

- *PRC §4423 (Burn permits required)*
- *PRC §4425 (Violation of burn permits)*
- *36CFR §261.52k (Violating state law relating to burn permits that threaten NF land)*

In most metropolitan and valley areas, debris burning is prohibited by air pollution control laws. In mountain areas, it is restricted. In a sense, slash and land management burning is debris burning. However, they are generally allowed under the agricultural or forest management exemptions. Such exemptions are in jeopardy if, in addition to fire safety, smoke production and drift are not properly managed.

Burning of household trash is commonly exempted in rural areas. However, the burning of industrial waste, including woody material resulting from clearing for construction projects, is usually not allowed unless the responsible fire protection agency certifies that the waste constitutes a fire hazard which cannot be abated in some other way. The same is true for burning done for the sole purpose of fire hazard reduction, such as along highway or railroad right-of-way.

Most fire agencies are happy to facilitate such burning projects when the permittee complies with all fire safety provisions and makes some effort to reduce smoke emissions. The local air quality management districts must also be contacted before burning. For waste disposal, this can usually be accomplished by achieving complete combustion in a high intensity fire. A forced-draft air supply is usually necessary. Several systems or pieces of equipment have been developed for this purpose.

For fire hazard reduction, where the primary purpose is usually to eliminate the fine (flash) fuels, both smoke emission reduction and the objective can best be obtained by following a prescription that produces a low intensity fire. This kind of fire will also be reasonably safe from escapes.

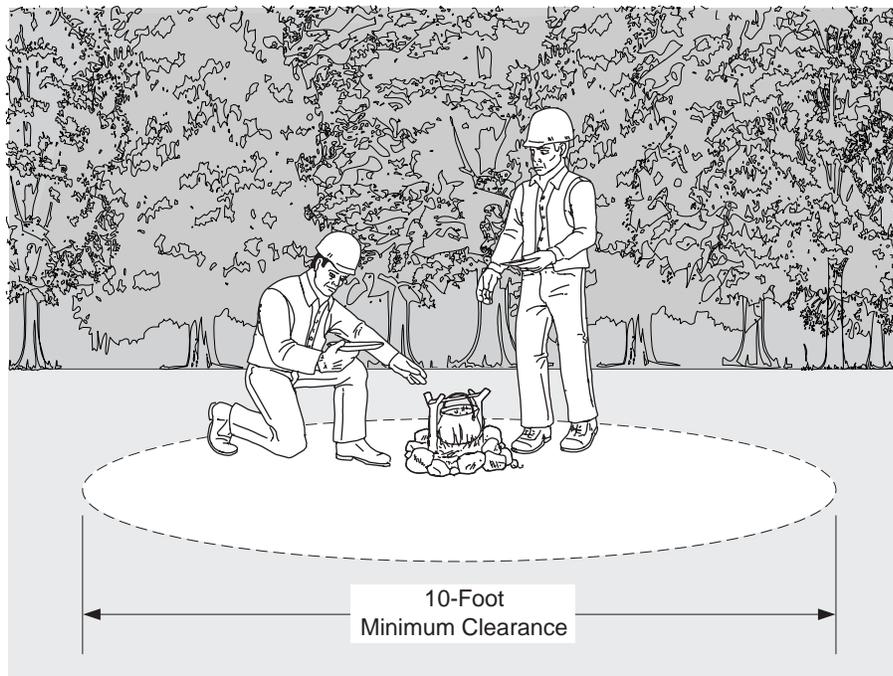


**Photograph 8-3.**  
**Low Intensity Ground Fire**

#### **8.4 Lunch and Warming Fires**

- *PRC §4432 (Neglecting campfire)*
- *PRC §4425 (Violation of campfire permit)*
- *PRC §4433 (Campfire permit required)*
- *PRC §4434 (Escape of campfire)*
- *Title 14CCR §918.5 (Lunch and warming fire requirements)*
- *36CFR §261.5f (Campfire clearances required on National Forest land)*
- *36CFR §261.52 (Campfire permits required and fire restrictions on National Forest land)*

Lunch and warming fires should be kept no larger than needed to cook or provide warmth. They should have a clearing to mineral soil for at least five feet in all directions from the perimeter of the fire. The fire should be confined to a depression scooped in the center of the clearing. At least one adult should be in attendance with firefighting tools (i.e., shovel, backpack pump and axe) readily available until the fire is completely extinguished. Extinguishment should be with water, checked by bare hand.



**Figure 8-4.**  
**Properly Prepared Campfire**

Under weather conditions creating “very high” or “extreme” fire danger, or a “Red Flag” conditions which indicates the probability of high winds, the use of lunch or warming fires should be prohibited. Since the workers may not be aware of these conditions, it is the responsibility of the company management to inform them and enforce the restrictions. Lunch and warming fires should only be used under the terms of a campfire permit issued by the appropriate fire agency and, if on private land, by the owner.

### **8.5 Infrared Scanning**

Infrared scanners can detect concentrations of heat which are not visible to the human eye (e.g., no smoke, area obscured by smoke or darkness).

Infrared scanners come in various models. The most useful to public or private fire specialists are those designed for mounting in aircraft and those that are hand held. In an aircraft (fixed-wing or helicopter), large areas can be checked quickly for holdovers from slash or land management burning or abandoned lunch and warming fires. The hand-held scanners are useful for checking specific suspect locations (e.g., recently extinguished lunch and warming fires, previously burned piles or wind-rows of slash, or areas near the control lines of wild or prescribed fires).