MANAGING COMPETING AND UNWANTED VEGETATION

METHODS INFORMATION PROFILE

Prescribed Fire

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There are five primary methods for treating and managing competing and unwanted vegetation: manual, mechanical, prescribed fire, biological, and chemical. These profiles are intended to aid Forest Service project managers, workers, and the public in planning and performing vegetation managementprojects. Prescribed fire is discussed here.

Fire can be used toreduce hazardous fuels, prepare sites for seeding or planting, rejuvenate forage for wildlife and domestic livestock, maintain firedependent species and ecosystems, control insects and diseases, and maintain habitat for threatened and endangered species. This discussion is limited to the use of prescribed fire as a tool to control competing and unwanted vegetation.

Implementation

The most common prescribed burning techniques are broadcast burning, pile burning, and underbuming.

Broadcast burning is the burning of material scattered over an open area such as a clearcUL Broadcast burns are usually ignited with handheld drip torches, although helitorches are becoming more widely used. A helitorch is a device suspended from a helicopter that drips flaming jellied gasoline. Helitorches are used where it is necessary to ignite an area rapidly, or when ignition by workers on foot is not safe. Rapid ignition makes it possible to burn at higher fuel moistures, which reduces the danger of fire escaping.

Mechanical pre-treatment is often done in combination with broadcast burning. Brush or saplings may be cut and scattered prior to burning. Logging residues may be crushed and compacted to reduce fire intensity and rate of spread. Unmerchantable material may be yarded from the unit by skidders or cable-logging machinery.

Pile burning of forest residues is done after piling or yarding unmerchantable material into piles or windrows. Piling is done by hand or with a tread or rubber-tired tractor.

Generally, windrows are burned in the fall after snowfall or rain to minimize the risk of escaped fires and air pollution. The most commonly used devices for igniting piles are hand-held driptorches and alumagel packets. Alumagel is a gasoline thickening agent. The jelled gasoline is put into plastic bags, placed inside the piled slash, and ignited electronically.

Underburning is burning beneath a forest canopy
to reduce woody debris, create sites for natural regeneration, reduce fuel loading, set back unwanted vegetation, or to encourage the growth of desirable forage and browse species. The handheld drip torch is used to ignite an underbum. This is done when the air temperature is relatively cool and there is sufficient wind to dissipate convective heat, which would otherwise damage the overstory. Relatively high duff/litter moisture contents are prescribed to limit consumption of the forest floor.

In deciding whether to bum and which technique to use, the quantity, type, distribution, and moisture contents of the burnable material are of primary importance. Temperature, wind, humidity, and topography - ruggedness, elevation and slope -must also be considered. Predictions must be made of the likely pattern and extent of smoke dispersed, the flame length, and rates of fire spreading.

Public perception may be a factor in deciding whether to use fire as a vegetation managment technique. A study by Manfredo et. al., (1990), compared public attitudes toward prescribed fire policies in the Wyoming/Montana area where residents had experienced the Yellowstone National Park fies with the nation as a whole. Respondents from the Montana/Wyoming region were slightly positive in their overall support for a controlled bum policy, while the nation at large was more evenly divided. The authors examine attitudes affecting beliefs and regional vs. national response patterns. . They concluded that while biological information may provide support for a prescribed fire policy, exclusive of areas dedicated to preservation, it is not in itself sufficient to justify use of fu-e where widely differing national attitudes about the effects of fire prevail. Other authors, (Shelby et. al.) also conclude that support for some uses of fire as a forest management tool will require consensus about the use and effects of fire as well as information, perception and treatment of public issues regarding fire.

Advantages

Wildfire plays an important role in natural ecosystems; when prescribed fire can mimic the critical aspects of wildfire behavior, it can produce similar effects. Fire may be the only effective method to maintain or restore threatened and endangered plants and overall plant communities which depend on periodic wildfire disturbance for perpetuation. With careful selection of burning conditions, prescribed fires can take advantage of the beneficial effects of fire while minimizing damage wildfire often causes.

Prescribed fire is effective on steep slopes, where other methods are difficult or impossible. It can also be less expensive than other methods.

Disadvantages

Selectivity is difficult to achieve consistently with fire. Also, burning may cause conditions that encourage the invasion of the treated site by other unwanted plants. Both of these effects depend on the heat tolerance, vigor, sprouting ability, and seed sensitivity of individual plant species and the duration and intensity of the fire.

Soil can be damaged and water quality degraded. Smoke from prescribed burning reduces air quality and the possible escape of a prescribed fire is always a serious consideration. Other potential problems associated with this method are discussed below under environmental and human health effects

Environmental Effects

Soil and Water

Prescribed fire can affect many components of the soil ecosystem: organic matter, especially the surface layers, nutrient capital and cycling, microorganisms, and erosion. Some of these potential effects are interconnected.

Loss of organic matter is the most serious fire effect. Soil fertility, stability and water storage may be reduced. Some of the nutrients stored in woody plants, litter, duff, and soil are released as gases during burning, and additional nutrients may be drained from the ashes in subsequent rainfall. This organic matter also cushions the force of raindrop impact and binds soil particles together. When the organic matter is lost, the mineral soil is more susceptible to dislodging by rainfall and downslope movement as surface erosion. At the same time, less water soaks into the soil, and water storage capability may be reduced.

Soil organisms may be directly killed by fire especially those in the surface organic matter. Soil can be sterilized by persistently high soil temperatures, which are generally present under fuel concentrations such as slash piles. Changes in soil nutrients, moisture and temperature patterns following fire may indirectly alter soil plant and animal communities.

The potential for prescribed buming to cause these adverse effects on soil productivity depends on the fuel and weather conditions under which burning takes place. Soil moisture, fuel quantities and moisture content, air temperature, humidity, and wind are all factors considered in burning prescriptions to reduce fire intensity and the consumption of organic material.

Site conditions further influence the potential for damage from the burning of organic matter. Sites with steep slopes and/or low inherent organic content are most vulnerable to damage. Singlegrained soils derived from granitic material or volcanic ash are most susceptible to surface erosion following burning.

Prescribed burning, if sufficiently hot, can produce hydrophobic (unwettable) soils which contribute to increased sedimentation, leaching nutrients from ashes, and increased run off during storms.

Air Quality

Prescribed burning has a direct effecton airquality. Forests in the Pacific Northwest Region must comply with state air quality standards. Average annual emissions in the Region are expected to decline significantly from 1983-85 levels due to a decline in acres burned and reductions in the amount of biomass consumed per burned acre. Visibility in Class I lands (wilderness and major recreation areas) will be protected from July 4 through Labor Day.

Vegetation

Variations in the timing and intensity of fire modify its effects on vegetation. Direct effects are limited to the time when burning takes place, but may last longer if soil fertility and biology is altered, or if undesirable plants become established in response to fire.

Where the organic layer is consumed by fire, numerous plants adapted togerminating on exposed mineral soils may become established. Among adapted species are important conifer trees such as ponderosa pine, lodgepole pine, and Douglas-fir. Some undesired brush or tree species, however, are equally or better adapted on specific sites. This includes western juniper and red alder and a number of noxious weeds. Ile seeds of some ceanothus and manzanita are stored in the soil and will germinate abundantly upon heating. Tanoak may resprout vigorously from below the soil surface. Increases in these species may adversely affect timber or forage production objectives, and require further treatment.

Productivity may be increased after site preparation if desired species can be quickly reestablished and occupy the disturbed site to the exclusion of undesired plants.

Wildlife and Rangeland

Variations in the timing and intensity of fire modify its effects on wildlife habitat Prescribed burning plans need to provide for protection and maintenance of large fallen logs and snags. These are important habitat components that can be consumed by fire.

Fire can be used to reduce accumulations of slash, improving access for some animals. Burning can stimulate the growth of plants eaten by big game, other wildlife species, and by livestock. Forage improvement and meadow restoration are highly dependent on prescribed burning to clear vegetation and prepare seedbeds.

Many types of vegetation are closely linked in their development to the influence of fire. Tne use of fire to create more of the “edge effect”, is superior to any other treatment method. There is increased richness of fiora and fauna in these transition zones where two plant communities or successional stages meet and mix.

Scenery and Recreation

Prescribed burning can temporarily reduce scenic quality. The magnitude of the change depends on how well the treatment blends with the natural character of a landscape.

Reductions in air quality and visibility from prescribed burning can adversely effect both developed and dispersed recreation.

Human Health Effects

The risk of any effect on human health from vegetation treatment is based on two factors. First, what are the hazardous characteristics of the tool that could cause and how would people be exposed to these hazardous characteristics?

The FEIS made quantitative, or numerical estimates of all known risks associated with each vegetation management tool and method. It also reviewed the quality ofthe scientific data that was used in maidng these risk estimates. For individual projecm site-s quantitative estimates need not be calculated in order to assess project risks. Rather, characteristics of the project should be identified that might expose either workers or the public to greater risks than those in the FEIS. Then planners must identify mitigating measures, from the FEIS or else where, and quality describe how effective they would be in reducing exposure.

Hazard

Both fire and smoke from prescribed burning can pose health hazards.

Short-term health effects of smoke may include eye and throat irritation coughing, and shortness of breath in thick smoke. People could be asphyxiated by prolonged entrapment in heavy smoke.

The components of forest fire smoke are fairly well-known but the amounts produced vary considerably, depending on fuel moisture and fim temperature. Hazards include gases (carbon monoxide, carbon and nitrogen oxides), tiny airborne particles, and chemicals that may enter the lungs on the swface of those particles.

Tiny pariculates can be inhaled deeply into the lungs and deposited there, along with attached chemicals. Particles may be irritating themselves and associated chemicals, such as aldehydes, are acute irritants. Other components, such as polyaromatic hydrocarbons (PAH) are known carcinogens. The most potent PAH has been demonsonstrated to increase in potency when mixed with particles.

Additional toxic compounds may be released when herbicide-treated vegetation is burned. As there is great variety in the chemical composition of herbicides, the potential for toxins being released from burning treated vegetation is addressed in the individual Herbicide Profiles.

The specific toxic agent in smoke from burning poison oak has been responsible for a large number of workers being incapacitated for a considerable period of time.

When a bum escapes and becomes a wildfire, severe bums and fatalities may result. Human habitat may also be lost.

Exposure

Worker exposure to fire depends on the number of prescribed bums and the acreage per bum.

Public exposure to fire depends on the number of escapedbumsthatbecomewildfires. This exposure from prescribed burning should be rare given normal precautions.

Particulate concentration has generally been used to estimate exposures to smoke. Besides measuring the actual particles, the concentrations of attached chemicals may be estimated proportionally. The gases produced by fire, on the other hand, decompose or are diluted rapidly. Although not a factor in off-site exposure, people in close contact with burning operations may be exposed to these gases.

Direct measurements of the concentration of particulate matter in the air have been made in communities located near areas of forest slash bums. These studies represent estimates of the maximum likely exposures of population centers to smoke components.

Smoke exposure for workers on prescribed fires would be much greater than for the general public. No direct measurements of workerexposures have been made, and no reliable procedure for estimating these exposures is available.

Workers on prescribed bums are exposed to additional hazards. Those who prepare sites by piling slash or cutting brush and small trees are exposed to injuries similar to those doing manual vegetation treatment. Workers who manually light bum areas would be exposed to diesel oil and gasoline as well as to the effects of smoke and fire.

Risk

Prescribed burning may create the risk of wildfire, physical injury to workers, and chemical or particulate effects from smoke.

Workers can experience injury and short-term effects fiom fire and smoke. They are at particular risk when prescribed fires escape. The risks to workers who are preparing sites for broadcast burning are comparable to those described for manual vegetation treatment.

The public is not likely to incur serious injury, although there is some indication that individuals may experience long-term health effects if they are exposed to smoke concentrations greater than state air quality standards.

Quality of Informadon on Health Effects

Information on the incidence of escaped prescribed burns and resulting injuries is available.

Information on the effects ofsmoke from prescribed burning is poor. While some smoke concentrations resulting from slash burning have been measured, most conclusions must be extrapolated from studies of air pollution from other burning activities.

Measures for Reducing Environmental and Human Health Effects

A written, site- c prescribed burning plan must be approved by a line officer. It must include:

- A description of the site and project objectives. This can include site prepamtion, hazard reduction, and biggame habitat improvement

- Expected results expressed quantitatively. Reduction of fuel loading, the number of planting sites, or the stimulation of forage production are typical objectives.

- Weather and fuel moisture criteria needed to achieve project objectives.

- The preparation of a Human Health Risk Management Plan.

- An indication of how the site will be monitored to determine when these criteria have been met

- The location of fire breaks, hose lays, and other physical elements required to conduct the project.

- An assessmentof the possibility ofescaped fire and an estimate of possible consequences. Measures which would be taken if this occurs must be spelled out.

- A plan for notifying regulatory and cooperating agencies and the public.

- Measures for managing smoke. Identify roads, airports, communities, residences, recreation and scenic areas requiring protection.

- Procedures for patrol and mop-up.

Information Sources

Manfredo, Michael J., Martin Fishbein, Glen E. Haas and Alan E.Watson, 1990, Attitudes toward prescribed fire policies, J.Forestry 88(7):19-23

Shelby, Bo and Robert W. Speaker, Public attitudes and perceptions about prescribed burning, in Natural and Prescribed Fire in Pacific Northwest Forests, edited by John D.Walstad, Steven.R.Radosevich and David V.Sandberg. Corvallis, Or.: Oregon State University Press, 1990, pp 253-260.