Status of Prescribed Burning and Air Quality in the South

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More than 2 million acres of forest land in the South have been prescribed burned annually during the past decade. The principal reasons for prescription burning, in order of importance, are: hazard reduction, site preparation, control of undesirable species, and wildlife habitat improvement. About 75 percent of the burning takes place in the 4-month period from December through March. Costs average less than $1.00 per acre.

There is little doubt but that prescribed fire is recognized as an essential tool of management in the pine forests of the South. It is a practical tool. It is inexpensive. It is effective. It can do more than one job with a single application. And it has been found to be safer and less damaging than other treatments. Man has not developed a competitive substitute to date, either from the standpoint of economics or practicability.

Yet in these days of environmental concern, resource managers find themselves between "a rock and a hard place." On the one hand, some ecologists contend that fire is a natural phenomenon essential to sound ecosystem management and, as such, should be allowed to

run its course. On the other hand, many of our environmentalists are concerned that open, free-burning fires are creating accumulations of smoke that are annoying and may be contributing to atmospheric contamination. It's little wonder that we feel trapped.

As we discuss the status of prescribed burning and air quality in the South, several basic facts cannot be ignored:

1. There is no evidence to show that air quality has deteriorated more where fire is used extensively as a prescription than it has where fire is not used.

2. All smokes are *not* the same. The products of forest fuel combustion (CO, CO_2, H_2O, HC, and particulates), coupled with the time and manner in which they are dispersed, make them more susceptible to nature's cleansing processes than other combustion effluents. Sulfur oxides (SO) are not produced, and the nitrogen oxides (NO) are formed only when high fire temperatures are experienced.

3. Preliminary evidence indicates that prescribed fires may indirectly improve the quality of the atmosphere by reducing the size and intensity of wildfires and, consequently, the emission load they put into the air.

4. If prescribed fires were to be outlawed or severely curtailed, we would be confronted with unbearable forest management costs, an intolerable fuel situation that would most assuredly lead to catastrophic wildfires, and a general decline in the productivity of our natural resources.

5. We are, nevertheless, sometimes faced with aggravating smoke problems when prescribed burns are made. When blankets of smoke cover major expressways or airports, or add to an already critical haze level in urban areas, we have a problem.

TO BURN OR NOT TO BURN

As long as we have forests, we'll have fuels. If we do not control the buildup of fuels one way or the other, we'll have fires and there's a good chance that many of them will cause excessive damage. If these projections are sound, then really the questions are: Should

we use prescribed fire to control our fuels; can we afford other means of fuel manipulation; can we develop less expensive alternatives; or can we develop new products and markets, and utilize the forest material we're now burning? Can we tolerate wildland fires, or should we build up our control forces so that we can subdue all wildfires before they have a chance to move out? As we review the status of prescribed burning in the South further, it is possible to answer some of these questions.

PROS

In the Coastal Plain pine forests, wildfires burn over less than 10 acres annually per 10,000 acres protected—where prescribed fire is employed as a means of hazard reduction. Where prescribed fire is not used, annual wildfire acreages during bad fire years may amount to about 700 acres per 10,000 acres protected. There is no doubt but that prescribed burning is paying off. No alternative hazard reduction treatment has yet been developed that can compare with fire from the standpoint of practicality and cost.

In addition to its capacity for accomplishing multiple objectives, prescribed fire has not been shown to have an adverse effect on soil productivity. In fact, analyses indicate an increase in the organic matter content of the surface 2 inches following 20 successive annual burns on the Francis Marion National Forest in coastal plain South Carolina. Growth rates in sapling and larger pine stands are increased slightly following well-conducted burns. Only where there is extensive crown scorch and needle consumption does growth suffer. In Piedmont trials, repeat burns in mixed loblolly pine-hardwoods on slopes up to 20 percent produced no measurable soil movement. Sedimentation in streams and water bodies is minimal; much less than that associated with other practices.

Investment costs are relatively low compared with other cultural treatments. Plowing assistance and necessary patrol are generally available from state forestry agencies.

Except for a short time following burning, the general appearance and accessibility of treated areas are enhanced considerably. Also,

the ecological makeup of southern pine forests is such that it may be disturbed more by fire exclusion than by judicious use. The southern pines are recognized as species that perpetuate themselves and generally grow best where light fires prevail; where fire is excluded, undesirable competing vegetation is quick to invade many sites. When this happens, returns from many of the renewable sources are often significantly reduced.

CONS

Three of the five products of combustion generally considered as air pollutants in the nationwide inventory are normally generated in prescribed burning. They are particulate matter, carbon monoxide (CO), and hydrocarbons (HC). The sulfur oxides (SO) are not produced in forest fuel combustion, and the nitrogen oxides (NO) are formed only when high fire temperatures are experienced. Nevertheless, some temporary impairment of the atmosphere, at the least, is a product of most prescribed burning.

Single burns are seldom adequate. As a general rule, a series of treatments is necessary during the life of a stand to achieve most prescription objectives. For example, consider the prescription that is designed to control unwanted understory species. Although the smaller hardwoods and shrubs are usually killed back with a single fire, the rootstocks sprout and in a short time the problem returns. Repeat burns are necessary to achieve ultimate control.

Prescribed fires occasionally turn into wildfires. Although there are inherent dangers in any prescription, one that utilizes fire will carry with it a degree of risk until such time as weather factors can be precisely predicted or controlled. Even the best planned burns are somewhat of a gamble. If they should get out of control, resulting damages may exceed benefits.

Ideal burning days are often few and far between. During the course of a scheduled burning season, optimum fuel and weather conditions seldom prevail for an extended period of time. In many instances, only a single day or two may occur when all conditions are considered ideal. Many of the suitable days are not predictable and consequently are not fully utilized.

When our country is faced with a fuel crisis, we cannot afford to ignore available fuel supplies. It has been estimated that from 5 to 10 million tons of forest fuel are going up in smoke each year from prescribed burning in the South. As much as 100 million tons might be available annually on a sustained yield basis if it could be utilized and marketed.

Finally, we cannot ignore the fact that considerable skill is involved in applying fire to the forest as a prescription. As an art and a science, it requires a period of apprenticeship and dedication that is not always possible or available. Neither can we ignore certain undesirable side effects that may, on occasion, outweigh the benefits achieved. The production of smoke itself can be both aggravating and dangerous when encountered on expressways and other travel lanes. We have learned that the aftermath of a supposedly successful prescription fire can be chaotic when residual smoke mixes with early morning fog to create an almost impenetrable curtain of darkness.

SMOKE AND AIR QUALITY

Particulate matter (smoke) is the principal pollutant from prescribed burning. It is, however, subject to some degree of manipulation and control through the selection of firing techniques and weather and fuel conditions that encourage adequate smoke dispersal. All of the Southern States have certain rules and regulations regarding "open burning;" yet, they all have exemptions which permit the prescribed use of fire for purposes of forest and game management.[1] For instance, in the States of Alabama, Georgia, Louisiana, and Virginia, any type of open burning is specifically prohibited when an air pollution episode exists. Arkansas, Georgia, North Carolina, South Carolina, and Oklahoma do not permit burning when prevailing winds will push smoke into cities, towns, and other smoke-sensitive areas. Georgia also stipulates that no prescribed burning be done in counties with populations exceeding 65,000. Tennessee restricts con-

[1] Ernst V. Brender and Hugh E. Mobley. 1974. Rules and regulations about prescribed burning and air quality. Forest Farmer. 33(4):10.

trolled burning when close to primary and secondary highways and airports. Many of the states prohibit burning when horizontal visibility is reduced to a level where highway and airport traffic is impeded. Some states limit prescribed burning to daylight hours. Florida and Alabama operate with an Air Stagnation Index that is used to gauge the feasibility of night burning.

Where state forestry agencies have participated in the formulation of rules and regulations, and where they have assigned responsibilities for implementing the rules, a sound basis for minimizing atmospheric contamination from prescribed burning has been established.

The manner in which particulate matter is put into the atmosphere is a function of (1) the amount and type of fuel consumed, (2) its moisture content, (3) the type of fire used, and (4) the rate of fire spread. The manner in which it is dispersed is a function of (1) atmospheric stability and (2) wind velocity. We believe it is possible to plug this information into models and derive estimates of maximum particulate concentrations with relation to smoke-sensitive areas. In this manner, it may be possible to identify go or no-go situations, as well as to select applicable firing techniques. The Southern Forest Fire Laboratory has developed a set of interim smoke management guidelines that is presently undergoing field evaluation.

IN SUMMARY

Combustion emissions from dead, dry forest fuel are considerably less than those from live, green material. For the most part, prescribed burning involves dead, dry fuel in contrast to wildfires where a high proportion of live, green material is included in the available fuel supply. In addition, whereas damaging wildfires are predominantly head fires in heavy fuels, prescribed fires are often backs and flanks in relatively light fuel. As such, they generally put much less foreign matter into the atmosphere than wildfires.

It is also logical to conclude that the smoke from prescribed burning is subject to more effective dispersion than that from wildfires. Weather conditions selected for good prescription burning are favorable for efficient smoke dispersion and dissipation. Wildfires

pick their own weather—often undesirable from the standpoint of combustion efficiency and desirable smoke dispersal.

Finally, evidence indicates that prescribed burning is indirectly improving the environment rather than damaging it. By reducing the number, size, and intensity of wildfires, this management practice cuts the overall particulate and gaseous production to less than 20 percent of what it might be. Also, it has been shown that the smoke particles from forest fires act as condensation nuclei that initiate precipitation. Rainfall is known as nature's most effective cleansing agent.

It is entirely possible that the smoke and other products of forest fire combustion may have other beneficial effects on the environment, but data are not available at this time to either support or refute this possibility. As we better understand the combustion process and atmospheric dynamics, we can better learn how to manage smoke from prescribed burning. In this way, we can make the most of a vital forest management tool.