

Restoring Fire to Ecosystems: Methods Vary With Land Management Goals

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Periodic forest, grassland, and shrubland fires are part of the natural environment—as natural and vital as rain, snow, or wind (Heinselman 1978). Evidence of past fires is found in charcoal layers in lakes and bogs, and in the fire-scarred cross sections of trees. Recurring disturbances by fire are essential to the functioning of many ecosystems, termed “fire-dependent,” that are found throughout North America (Heinselman 1978). Many examples are available to describe how fire affects the functioning of ecosystems, such as influencing plant succession, fuel accumulations, structure and composition of vegetation, insect and disease populations, nutrient cycling, productivity, diversity, and habitats for wildlife.

Kilgore and Heinselman (1990) highlighted fire’s historical role as a fundamental disturbance process in their classification of “continental fire regimes.” They described a natural fire regime as the total pattern of fires over time that is characteristic of a region or ecosystem. They also defined fire regimes as to fire type and intensity, typical fire sizes and patterns, and fire frequency, or length of return intervals in years (Agee, this proceedings). The noteworthy aspect of continental fire regimes is that few plant communities in North America occur where fires historically were rare or absent. In other words, most ecosystems in the United States evolved in environments where wildland fires occurred regularly, establishing fire as a process that affects many ecosystem functions. The application of prescribed fire, for many different purposes, attempts to mimic the diverse effects within the natural role of fire. However, prescribed fire has not been used on a scale adequate for sustaining the productivity of fire-dependent ecosystems.

After reviewing some prescribed fire accomplishments in the United States, we will identify several pending recommendations that could modify the future of prescribed fire.

Fire Science and Fire Prescriptions

Lightning, volcanoes, and people have been igniting fires in wildland ecosystems for millennia. The current emphasis on managing ecosystems highlights interactions between disturbance processes and ecosystem functions. Land managers and fire managers need to understand the historic

frequency, intensity, and the areal extent of past fires. Such knowledge provides a frame of reference for prescribing appropriate management practices on a landscape scale.

Many studies have reported on the historical occurrence of fire throughout the world. For example, Swetnam (1993) submitted a report documenting 2,000 years of fire history in giant sequoia (*Sequoiadendron giganteum*) groves in California. He found that frequent small fires occurred during a warm period from about 1000 to 1300 A.D. The less frequent but more widespread fires occurred during cooler periods from about 500 to 1000 A.D. and after 1300. Swain determined from lake sediment analysis in the Boundary Waters Canoe Area that tree species and fire had interacted in complex ways for more than 10,000 years (Swain 1973). A great deal of scientific information provides details on the many effects of wildland fire on ecosystems. This knowledge allows managers to develop prescribed fire program prescriptions for individual fires and to achieve a variety of resource management objectives.

How widespread is the use of prescribed fire in the United States today? Federal land management agencies manage more than 600 million acres. A recent survey showed that prescribed fire in the United States is used to treat about 5 million acres annually (Ward and other 1993). More than 3.5 million acres, or 70 percent of all prescribed burning, was in the Southeast. Purposes for using prescribed fire included hazard reduction, silviculture, vegetation management, range improvement, wildlife habitat improvement, and “other” reasons, including watershed management, pest control, disease control, and research. A category apparently not covered in the survey was prescribed natural fire in National Parks and wildernesses. Many National Parks and wildernesses across the United States have approved plans that allow lightning fires to burn when they have met all identified prescription criteria. Some of these individual prescribed natural fires have been 10 to 15 thousand acres or greater in the Rocky Mountains (Kurth, this proceedings; Parsons and Botti, this proceedings).

Decline of Ecosystem Health

Many ecological indicators from the Southeast to the West present an alarm of declining forest health. Attempts to exclude fire since the early 1900’s, combined with drought and epidemic levels of insects and diseases, have now produced extensive forest mortality. Gray (1992) called attention to a forest health emergency in the Western United States. He cited widespread forest mortality that has occurred across millions of acres in eastern Oregon and Washington and similar problems in forests of Utah, Nevada,

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California, and Idaho. The historical norm in long-needled pine forests (ponderosa pine, etc.) throughout the west was for frequent low-intensity surface fires. Now, dense stands and heavy fuel accumulations are setting the stage for high-intensity crown fires.

Since the 1980's, large wildfires in dead and dying western forests have accelerated the rate of forest mortality, threatening people, property, and natural resources (Mutch 1994). These wildfires also produce large amounts of smoke. More than 50 years ago, Weaver (1943) reported that the "...complete prevention of forest fires in the ponderosa pine region of the Pacific slope has certain undesirable ecological and silvicultural effects...conditions are already deplorable and are becoming increasingly serious over large areas." Cooper (1961) stated that "fire has played a major role in shaping the World's grassland and forests. Attempts to eliminate it have introduced problems fully as seriously as those created by accidental blazes."

Some have said that we have been engaged in a grand ecological experiment with this attempt to exclude fire from fire-adapted ecosystems. Fire exclusion is a problem even in the southeastern United States where the majority of prescribed burning is conducted because the scale of such burning is very inadequate (Landers and others 1995). About 90 million acres of longleaf pine (*Pinus palustris*) existed during the late nineteenth century in the Southeast. Due in part to the absence of fire, today's stands occupy only about 2.9 million acres.

Our Prescribed Fire Future

Use of prescribed fire along with other management practices is part of the solution in sustaining healthy forests to benefit people. Developing strategies for reintroducing fire on a landscape scale will require overcoming many barriers imposed on land managers either directly or indirectly. The present strong fire suppression programs are essential, but must be complemented by equally well supported prescribed fire programs to overcome the following barriers to burning: air quality, water quality, threatened and endangered species, visual quality, funding, and risks.

In May of 1995, the Forest Service released a comprehensive report with findings and recommendations to help the fire management program overcome major obstacles (USDA Forest Service 1995). Five key recommendations were set forth in this report:

1. Restoring ecological processes: Increase mechanical (for example, thinning) and prescribed fire treatments to 3 million acres a year (five times the current levels) in fire-dependent ecosystems by the year 2005. Emphasize the appropriate ecological recovery efforts on recently burned wildfires.

2. Sustaining fire-dependent ecosystems: Establish a multi-funded, interdisciplinary account for restoration and maintenance of fire-dependent ecosystems by the year 2005. Develop a workforce capable of restoring these ecosystems.

3. Forest land management planning: Address the ecological basis for fire across the landscape. Fully display the long-term consequences anticipated as a result of both fire use and attempted fire exclusion. Establish prescribed fire objectives and assess fire consequences within the land management planning process.

4. Wildland/urban interface: Renegotiate agreements with state and local cooperative fire agencies at the wildland/urban interface to clarify protection responsibilities. Phase out the Forest Service as a primary protection agency in suburban and developing rural areas.

5. Reorienting the workforce: Move toward preparing 75 percent of the total workforce to be trained, qualified, and available to support fire management by the year 2000.

With this strategy it is apparent that the Forest Service fire management program is positioning itself to greatly improve its ability to restore fire in National Forests.

Current Solutions

Some breakthroughs in providing more latitude for expanding prescribed fire programs are apparent. For example, the state of Florida has enacted innovative legislation that provides liability protection for prescribed burning. In Oregon, a cooperative program among Federal and state agencies is developing a fire emissions tradeoff model (USDA Forest Service 1993) that predicts smoke emissions from prescribed fires and wildfires in the Blue Mountains. The goal of this effort is to design a prescribed burning and fuel treatment program that reduces overall smoke emissions (Ottmar, this proceedings).

The Western States Air Resources Council (WESTAR), a nonprofit association of air quality agencies in the 14 western states, has drafted an initiative entitled "Forest Health Initiative to Restore Ecosystems" (FIRES) to address both technical and policy-related issues for forest health and air quality. The goal of the 3 year project is to bring together a broad-based consortium to develop regional solutions based on science and to balance the needs of forest health while protecting air quality. FIRES will respond to the concerns of Congress, the western state air regulators, Federal land management agencies, and the public (WESTAR 1994). These initiatives help to provide more latitude for prescribed fire programs to evolve in a more supportive environment.

Because many stands are now excessively dense and contain many dead and dying trees (Mutch and others 1993), salvage logging, thinning, and partial cutting may be necessary before initiating extensive prescribed burning programs (Arno and others, this proceedings). The larger trees of fire-resistant species, such as ponderosa pine and western larch, should be retained, and understory trees should be largely removed.

In other situations, resource managers and fire managers have conducted some landscape scale prescribed burns, including the following examples from 1993 and 1994: a 16,000 acre burn on the Santa Fe National Forest; a 700 acre prescribed fire for wildlife winter range on the Lolo National Forest; a 1,000 acre burn on the Boise National Forest; a 6,000 acre prescribed fire on the Umatilla National Forest; and a 5,000 acre aerially ignited crown fire on the Tetlin Wildlife Refuge in Alaska (Vanderlinden, this proceedings).

Conclusions

Resource management agencies, regulatory agencies, politicians, and society have a challenging opportunity to carry

out meaningful ecological restoration programs. These must be at a scale large enough to sustain the health of fire-adapted ecosystems, benefiting people, property, and natural resources. Society needs to move away from litigation and the courtroom as strategies for managing natural resources. Instead, we should employ the available scientific knowledge and management experience for managing wildland ecosystems more in harmony with disturbance factors.

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