Wildfire Policy and Public Lands: Integrating Scientific Understanding with Social Concerns across Landscapes

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Abstract: *Efforts to suppress wildfires have become increasingly problematic in recent years as costs have risen, threats to firefighter safety have escalated, and detrimental impacts to ecosystems have multiplied. Wildfires that escape initial suppression often expand into large, high-intensity summer blazes. Lost is the legacy of smaller fires that likely burned outside extreme weather and fuel conditions and resulted in less severe impacts. Despite the recognized need for modifications to existing policies and practices, resource agencies have been slow to respond. The spread of exotic species, climate change, and increasing human development in wildlands further complicates the issue. New policies are needed that integrate social and ecological needs across administrative boundaries and broad landscapes. These policies should promote a continuum of treatments with active management and reduction of fuel hazard in wildland-urban interface zones and reintroduction of fire in wildlands. Management goals should focus on restoration of the long-term ecological health of the land. Projects that reduce fuel loads but compromise the integrity of soil, water supplies, or watersheds will do more harm than good in the long run. Despite significant ecological concerns, learning to live with fire remains primarily a social issue that will require greater political leadership, agency innovation, public involvement, and community responsibility.*

Key Words: forest management, U.S. Forest Service, policy, public lands, wildfire

Políticas para Fuegos No Controlados y Tierras Públicas: Integrando el Conocimiento Científico con los Intereses Sociales en Paisajes

Resumen: *En años recientes, los esfuerzos para suprimir los fuegos no controlados se han vuelto cada vez más problemáticos por el incremento de costos, el aumento de las amenazas a la seguridad de bomberos y se la multiplicioń de los impactos perjudiciales a los ecosistemas. Los incendios que escapan la supresión inicial a menudo se expanden a grandes conflagraciones estivales de alta intensidad. Se ha perdido el legado de fuegos menores que probablemente se llevaban a cabo en condiciones climáticas y de combustible extremas que tenían impactos menos severos. A pesar del reconocimiento de la necesidad de modificaciones a las políticas y prácticas actuales, las agencias han respondido lentamente. La expansión de especies exóticas, el cambio climático y el incremento del desarrollo humano en áreas silvestres complican el problema aún más. Se requieren políticas nuevas que integren necesidades sociales y ecológicas más allá de límites administrativos y en paisajes amplios. Estas políticas deben promover un continuo de tratamientos con gestión activa y reducción de riesgo de combustión en la interfase área silvestre-urbana y la reintroducción de fuego en áreas silvestres. Las metas de la gestión deben enfocar en la restauración de la salud ecológica a largo plazo. Los proyectos que reducen la carga de combustible pero que comprometen la integridad del suelo, las reservas de agua o cuencas hidrológicas no serán de mucha utilidad en el largo plazo. A pesar de preocupaciones ecológicas*

Paper submitted October 28, 2003; revised manuscript accepted December 16, 2003.

significativas, aprender a vivir con fuego seguirá siendo un aspecto social que requerirá de mayor liderazgo político, innovación de agencias, participación del público y responsabilidad comunitaria.

Palabras Clave: administración de bosques, fuego no controlado, política, Servicio Forestal Estados Unidos, tierras públicas

How Wildfire Defines Policy: Historical Review

The history of wildfire in the United States and our attempts to control it contain many lessons to guide future policies for management of public and private lands. Destructive fires that ravaged the West and Midwest in the late 1800s and early 1900s led to federal policy declaring that all wildfire is bad. Wildfire was viewed as a destructive force that must be contained. Following World War II, this goal of suppressing all wildfires nearly became a reality with the availability of scores of firefighters, heavy construction equipment, smoke jumpers, and aerial tankers. Agencies seemed to be winning the war against wildfire, contributing to the illusion that all wildfire could be excluded from the land. The Yellowstone Fires of 1988, however, served to remind us of the unpredictability and occasional futility of our fire-control policies. Seemingly catastrophic wildfire seasons in recent years have reinforced the contention that a new approach to wildfire is needed.

Much of our western landscape evolved with wildfire and depends on this natural process to recycle nutrients, improve soil productivity, start plant succession processes, and contribute to overall watershed health. Our zealous efforts to suppress wildfire have diminished these ecological functions and altered fire regimes across much of the West (Agee 1993, 1997). Agencies and the scientific community have made progress in recognizing what ails our forests and grasslands, but our legacy of treating fire as a dangerous and destructive force has made agencies slow to translate improved scientific understanding into on-the-ground management changes. As a result, half the year is spent in widespread talk about the need to reintroduce fire into fire-adapted ecosystems, but the other half of the year is spent suppressing all wildfire at substantial economic cost. The federal fire bureaucracy spends hundreds of millions of dollars annually on wildfire suppression, more than a billion dollars in a "bad" fire year, with little oversight or accountability (General Accounting Office [GAO] 1999, 2001).

The years from 1871 to 1910 reshaped public opinion on wildfire. At that time, fire was used to clear land for agriculture or to drive wildlife, or was inadvertently started along railroads. By the late 1800s, the combination of drought and slash left behind by logging began producing large and uncontrollable wildfires. The 1871 Peshtigo Fire in northeastern Wisconsin, in which some 1500 people died and more than 486,000 ha burned, remains the single most tragic wildfire in our history (Pyne 1982). Fires in Michigan, again the legacy of timber cutting, burned another 1.0 million ha that same year (Pyne 1982). Forest cover was destroyed and topsoil turned to ashes or washed away once the forests were burned. The land lost its ability to dampen floods or temper drought. Watershed function—the basic ability to catch, store, and release water over time—was lost across broad landscapes. By 1900, 32 million ha of charred and decimated stump lands lay east of the Mississippi.

The West was not far behind. The year 1910, the year of the Great Fires, created the foundation for how federal agencies would relate to wildfire (Pyne 2001). The U.S. Department of Agriculture Forest Service (USFS), founded only 5 years earlier, was a fledgling agency with few resources. A combination of slash-and-burn forestry, expanding railroads, drought, and wind caused more than 2.0 million ha to burn that year across the West, mostly in Idaho and Montana. Seventy-eight firefighters died, numerous civilians perished, and several towns burned to the ground. Ultimately, the U.S. Army was called in to fight fires throughout the West. The destructive fires of 1910 led the federal government to declare war on wildfires. The USFS responded with military-like zeal and declared fire suppression its primary charge. Leaders in the agency believed that the only solution to fires was "the full-scale development of the forests with roads, trails, telephone lines, lookout towers, and a resident staff sufficient to patrol and attack fires while they were small" (Pyne 2001). By 1935 the "all fires out by 10 AM" policy was formally adopted (Pyne 1982). By the 1940s, the USFS had developed the most effective wildfire-fighting capability in the world. As a result of this early and widespread intervention in wildfire, we lost the legacy of many smaller fires that were likely to have burned at lesser intensities.

Smokey Bear and his slogan—"Remember, only you can prevent forest fires."—was perhaps the most successful public awareness campaign ever. In 1968 a national advertising company noted that Smokey was the most popular symbol in the United States, better known than the president (Pyne 1982). The perception that all wildfire is bad became universal. The National Interagency Fire Center was established in Boise, Idaho, in the 1960s as the wildfire-fighting command center and soon became a model of government interagency cooperation.

In 2000 wildfires were front-page news from May to September, starting with the loss of over 200 homes in the Cerro Grande Fire in Los Alamos, New Mexico, and

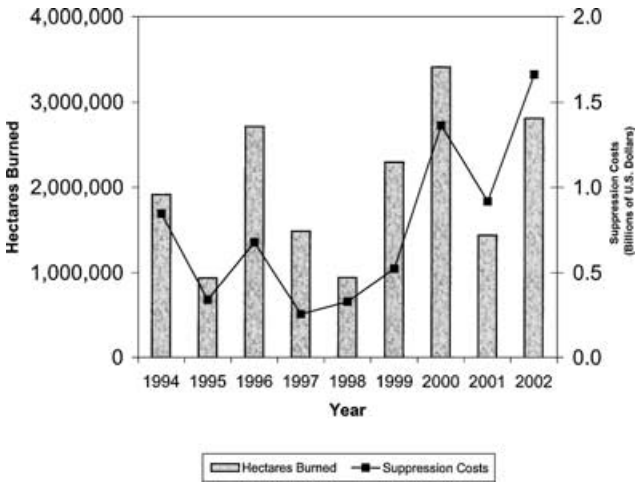

Figure 1. Hectares burned in the United States and wildfire suppression costs for federal agencies, 1994–2002. Data from National Interagency Fire Center (2003).

continuing with multiple large fires in Montana and Idaho. The years 1988, 1994, 2000, and 2002 were clarion calls that society's century-long attempt to control fire in the fire-adapted ecosystems of the West was not working. With advanced technology and an army of firefighters, 98% of wildfires are typically snuffed out in the initial attack. In spite of this extraordinary "success," the total amount of the landscape burned each year has increased in recent decades compared with the mid-1900s (Agee 1997), and more than 2.5 million ha burned each year in 1963, 1969, 1988, 1996, 2000, and 2002 (an average of 1.6 million ha has burned each year between 1960 and 2002) (National Interagency Fire Center 2003). The costs of wildfire suppression have risen in recent years as more land has burned (Fig. 1). More than $1 billion was spent in 2000 and 2002 by federal agencies (National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs, Bureau of Land Management, and Forest Service) fighting fires on public lands. Clearly this is an economic burden that cannot continue indefinitely, especially for federal land-management agencies that are otherwise underfunded for basic resource inventory, monitoring, and management.

For nearly a century, the widespread suppression of fire and other factors, such as livestock grazing, past timber harvest practices, and other human activities, have resulted in altered ecosystems and more broad-scale wildfires during dry years. In many cases, it is our interruption of natural processes that reduces the ability of the land to heal itself, resulting in even more serious problems. Scientific assessments indicate that in the Interior Columbia River Basin, prior to European settlement, about 2.4 million ha burned per year (Hann et al. 1997). With recent intense fire suppression, less than 203,000 ha has burned each year (Hann et al. 1997). In spite of a century of fire suppression, we have learned that the question is not if forests will burn but when, where, and with what intensity.

Challenges of Natural Complexity, Exotic Species, and Suburban Sprawl

For agency policies concerning wildfire to be effective in the long term, they must be specific to local forest conditions and adaptable to new information about the natural environment and to changing social concerns. The spread of exotic species is a good example of the need for policies to adapt to changing situations. The Department of the Interior estimates that noxious weeds spread at a rate of 688,500 ha annually (Bureau of Land Management 1996). Exotic grasses, noxious weeds, and other alien species are among the greatest threats now facing the integrity of public lands (Dombeck et al. 2003).

If their seeds or spores are present, exotic species will thrive and spread, complicating fire-suppression activity. Fire engines, bulldozers, or other vehicles may spread exotic species as well (Backer et al. 2004). Federal agency wildfire policies, management actions, and research on wildfire must respond to such threats from exotic species. For example, burn-area emergency rehabilitation efforts should recognize that grass seeding for erosion control often degrades native species recovery and that long-term damage to ecosystems often overshadows short-term gain in soil stabilization (Beyers 2004 [this issue]). Even the use of "certified weed-free hay" for erosion control may be suspect when the amount free of weeds is only 95% or even 99%. The use of weed-free hay on post-fire recovery efforts in the Klamath National Forest resulted in the introduction and spread of exotic yellow starthistle (*Centaurea solstitialis* L.) on forest lands (J. Perkins, personal communication). During the massive Biscuit Fire in 2002, the USFS required that equipment be power-washed or rinsed with chlorine-treated water to prevent Port-Orford Cedar root disease, which is spread by water or mud contaminated with exotic *Phytophthora* spores. This is a good example of how federal agencies can and should apply ecologically sound management even during emergency wildfire situations.

Wildfire suppression, introduction of exotic species, livestock grazing, timber harvest practices, and replanting cutover lands with dense conifer plantations have changed fuel loads and fire regimes in many western forests and grasslands. A recent broad-scale assessment of national forest lands and land administered by the Bureau of Land Management (BLM) in the Interior Columbia River Basin documented a 25% increase in young trees in dry forest types such as ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and dry grand fir (*Abies grandis* [Dougl.] Lindl.)–white fir (*A. concolor* Gord. & Glend.)

associations in Idaho and western Montana (Hann et al. 1997). The assessment also found that ponderosa pine has been replaced by grand fir and white fir in 19% of its range and by Douglas-fir (*Pseudotsuga menziesii* Mirb.) in another 20%. Open, park-like stands of ponderosa pine were estimated to be at 25% of their historic range, whereas Douglas-fir and true firs had more than tripled their range (Hann et al. 1997). Overall, the assessment concluded that 46% of National Forest and BLM forestlands in Idaho, western Montana, eastern Washington, and eastern Oregon were at a low rating for overall ecological integrity. Most private lands in the region are in even worse condition. Of the lands classified in the report as low in ecological integrity, 61% occur outside of federal management (Quigley & Arbelbide 1997).

By the 1990s, the complexity and patchiness of many fire-adapted forest ecosystems were greatly diminished. Young Douglas-fir, grand fir, and other species formerly controlled by small fires were growing in large numbers. The meadows were disappearing, and the remaining large pines were surrounded by smaller trees that competed for water during droughts and provided "ladder fuels" that allowed fire to reach upper branches to torch and kill trees. The GAO (1999) reviewed the status of western forests and concluded that the over-accumulation of trees presented a severe wildfire risk to approximately 16 million ha in the Intermountain West.

Some forests have naturally high fuel loads and a history of stand-replacing wildfires that burn at high intensity (Agee 1993). Lodgepole pine (*Pinus contorta* Dougl. ex Loud.) forests in the West, for example, require high-intensity fires to reseed and restore themselves. Other forests, occurring for example in the Klamath-Siskiyou region of northwest California and southwest Oregon, are characterized by fires that burn at mixed intensities (Odion et al. 2004 [this issue]). Forests characterized by high- or mixed-intensity fires present special concerns that cannot be addressed simply by policies that seek to reduce tree densities or fuel loads.

Wildfires that burned in Oregon's Siskiyou National Forest during 2001 and 2002 illustrate this complex dilemma. In September 2001, lightning started the Craggie fire in the Kalmiopsis Wilderness. The fire was in extremely rugged terrain and posed no threat to structures. The 39,000-ha Silver fire had burned the same area in 1987, and other large fires were known from the same area in 1938 and the summers of 1917 and 1918 (T. Atzet, personal communication). Rather than being allowed to burn, the Craggie fire was immediately attacked by aerial tankers and helicopters. By the time it was controlled, 111 ha had burned with a suppression cost of $2.2 million. Forest Service policy dictated that the fire be attacked and controlled because of dry conditions and high fuel loads despite the shorter days of mid-September and the onset of cooler and moister weather. To some, allowing the Craggie fire to burn might have seemed risky. But the alternative is a fire in some future year that occurs in the middle of summer with even more fuel present.

This is precisely what happened in 2002. In July of that year, during a hot, dry summer, lightning started a series of fires in Oregon, including several in and around the Kalmiopsis Wilderness. Because of the large number of fires burning at that time, no firefighters were available to fight the Kalmiopsis fires for the first 4 days. In the dry, rugged terrain and hot weather, the wildfires grew rapidly. In August, several fires around the Kalmiopsis combined to form the Biscuit fire and spread to 116,000 ha with more than 2000 firefighters on the lines. By the time the Biscuit fire was contained in September, fire had swept across nearly 203,000 ha despite thousands of firefighters, dozens of bulldozers, and many air tankers. Firefighting costs reached $150 million, making this the most expensive fire fought in the nearly 100-year history of the USFS, even more expensive than the previous record, the Yellowstone fires of 1988, which cost $120 million to suppress. The costs of such massive firefighting efforts are not just high in terms of dollars, but also in terms of firefighter safety, damage caused by bulldozers to fragile soils and sensitive botanical areas, and the potential for spread of exotic organisms by firefighting equipment.

In spite of the impression created by media reports that the Biscuit fire destroyed the forest, the fire burned in a classic mosaic pattern across the landscape. This benefits many ecosystem functions and restores habitat diversity. According to burn-area emergency rehabilitation surveys by the USFS, approximately 16% of the area burned at high severity, 23% at moderate severity, and 41% at low severity, and 20% was unburned or burned at very low severity (Siskiyou & Six Rivers National Forests 2002). According to the report, 70% of the area that burned at high severity contained enough surface rock to protect soil against accelerated erosion. In the long run, restoration of fire will occur in one form or another. How fire returns to these fire-adapted ecosystems is the question.

An expanding human population, especially in western states, is the single greatest factor confounding federal fire-management policies. Nearly all western states are growing faster than the national average. According to the U.S. Census Bureau, population increased 13.2% nationally from 1990 to 2000 but increased 28.5% in Idaho, 29.6% in Utah, 30.6% in Colorado, 40.0% in Arizona, and 66.3% in Nevada during this same period. Much of this growth occurred as urban areas sprawled into surrounding wildlands. Only two western states, Montana (12.9% increase) and Wyoming (8.9%), fell below that national average.

With an increase in home construction along wildland boundaries and private inholdings within national forests and BLM public lands, federal agencies are focusing more of their firefighting efforts on protecting human lives and property. But in the debates that followed the intense fire seasons of 2000 and 2002, too little discussion focused

on the central issue of homeowners assuming more responsibility for reducing the vulnerability of their homes to wildfire by building with fire-resistant materials and storing flammable materials away from structures. In the western United States, few communities or local governments have enacted zoning requirements to guide the growth of homes along the wildland-urban interface or building requirements to reduce the flammability of structures. And insurance companies do not require "fire-wise" practices as a condition of insurability.

Toward Policies that Reflect Ecological and Social Needs

The magnitude of the fires in 2000 and a 1999 GAO report on the need for a cohesive strategy for wildfires resulted in development of the National Fire Plan and associated fire-management policies by the USFS, National Park Service, U.S. Fish and Wildlife Service, BLM, Bureau of Indian Affairs, and National Association of State Foresters. The National Fire Plan, developed in 2000, spelled out a $10-billion effort over a 10-year period to protect communities and restore healthy forests in fire-adapted ecosystems (USFS 2000). In 2002 President Bush's Healthy Forests Initiative called for modifications to the National Fire Plan that would expedite fuel-reduction projects by reducing environmental impact analysis, public involvement, and appeals and litigation associated with the National Environmental Policy Act (Office of the President 2002).

Most ecologists and agency administrators agree that reducing the levels of hazardous fuels on forests and rangelands is essential to protect adjacent human communities and to restore healthy watersheds. The agreement ends here, as some in the timber industry call for aggressive logging to restore forests and the environmental community decries such a rationale as simply another way to increase timber cutting. The public land manager walks a fine line. Even the most well-reasoned decisions often result in criticism.

The priority for fuels management should be places where forests and communities intersect, such as wildland-urban interface zones and watersheds that supply municipal drinking water. If such areas contain uncharacteristically high fuel loads, projects that thin small trees and remove brush followed by the careful use of prescribed fire should be welcomed by a broad cross-section of interests. On the other hand, building roads and cutting trees in remote roadless areas far from human communities makes neither ecologic nor economic sense (DellaSala & Frost 2001).

Local communities need to shoulder greater responsibility for regulating sprawl and for encouraging proactive efforts by homeowners to reduce the risk of home ignition during wildfire. In remote or inaccessible wildlands, wildfires should be closely monitored but allowed to burn if outside of extreme summer weather and not threatening to human communities. In roaded and previously logged areas that are not part of the wildland-urban interface, management should focus on utilizing fire processes at a low risk—under acceptable weather conditions and fuel loads—and thinning small-diameter materials as prescribed by the local management context and to restore the health and integrity of the land. Meanwhile, fire programs of federal agencies should focus the overwhelming majority of their hazardous-fuels reduction and suppression efforts on protecting lives and property in the areas where forests and communities meet, including efforts to help landowners reduce fire risk in the immediate vicinity of their homes. Such an approach would help restore natural fire cycles in remote places, save tens of millions of dollars, and, above all, minimize risks to firefighters.

This is not to say that a let-it-burn philosophy should prevail in all areas. The challenge is to put fire back on the land in a way that minimizes the risk to people and communities while mimicking natural fire regimes to the extent possible. We should allow what would have historically been the smaller wildfires to burn, including those that naturally start early or late in the fire season when weather can moderate fire intensity. Many forests evolved with fire and indeed need fire for healthy development. The complicating factor is increasing human population. The sprawl of housing developments in rural areas, foothills, and even on mountainsides is occurring all over the country, especially in fire-prone areas such as California and the Intermountain West. Making matters worse, many homeowners fail to take steps to protect their homes and lives such as avoiding flammable wood roofs and cedar siding, keeping woodpiles away from the home, clearing vegetation adjacent to the house, and other common-sense precautions (Cohen 2000). The most important factors determining whether a building will burn during a wildfire are the degree of flammability of construction materials and fuels within 40 m of buildings (Cohen 1999, 2000). People who build homes in fire-adapted landscapes must assume responsibility for reducing fuels and the ignitability of buildings and the immediate space around their homes. Local government zoning ordinances should take into account fire-prone areas as they already do for flood-prone areas.

Traditional organizational structures and appropriations make increased interagency coordination of wildfire management difficult (GAO 2001). Nonetheless, reducing wildfire risk while restoring healthy watersheds will require a new level of coordination among federal agencies, state governments, and the public. Substantial interagency cooperation has been achieved in fire suppression through the National Interagency Fire Center in Boise, Idaho. It is time that similar levels of cooperation be developed for wildfire reintroduction through careful monitoring of wildfires in roadless and wilderness areas and expanded but judicious use of prescribed fire. Public

Table 1. Recommended principles and rationales for developing wildfire policies that meet ecological and social needs.

Principle	*Rationale*
Integrate policies across both private and public lands.	Wildfires know no boundaries.
Strengthen coordination across agencies and communities for wildfire introduction.	Interagency coordination has improved wildfire suppression, and the same coordination is needed to reintroduce wildfire successfully.
Develop a continuum of priorities and actions between urban and wildland environments.	Meeting social concerns through more active management is appropriate in urban areas, whereas meeting ecological needs is more important in wildland areas
Strengthen homeowner education to reduce ignitability of their homes.	Home characteristics and vegetation within 40 m of structures principally determine potential for home ignition during extreme wildfires.
Value forest diversity and variability in historic fire regimes.	The substantial variation in plant communities, fuel loading, and fire regimes must be recognized to maintain and restore diversity.
Wildland policies should emphasize ecosystem resilience rather than fire control.	Wildfire is critical to maintaining the diversity and productivity of many natural communities.
Encourage reintroduction of ecologically appropriate fire where possible.	Historic fire regimes should be reestablished except where development densities dictate alternate approaches.
Ensure monitoring, evaluation, and public involvement in fire management policy.	Adaptive management is needed to address natural complexity and change; increased public involvement is needed to foster understanding and public trust

participation in the process should be strengthened, not weakened, in order to build trust and integrate the concerns of communities. New relationships must be forged across disciplines and administrative boundaries to successfully implement policies and plans. Some preliminary principles for developing ecologically and socially responsible wildfire policies are presented in Table 1.

It is important that wildfire policies be well founded in ecological principles. It will do little good in the long run if projects that reduce fuel loads compromise the basic integrity of soils, water supplies, or watersheds. Fuel management should be part of a broader strategy of restoring watershed health rather than designed solely on the basis of fuels. As important as ecological principles are, however, living with fire largely remains a social issue that will require greater agency leadership and community responsibility.

Although government agencies and land managers tend to be adverse to risk, leadership must support innovation and adaptive management to achieve success. To avoid risk in wildfire management today is to advocate even larger uncontrolled wildfires with greater threat to human life, property, and ecosystems in the future. Neither thinning nor extensive logging will fire-proof our forests. Planning in fire-adapted ecosystems requires an understanding of local forest type, fire history, potential fire behavior, past management actions, land-use changes, watershed needs, species viability, and relative risk to human communities (USFS 2000). Uncertainty associated with these factors can best be addressed through adaptive management—the process of monitoring, evaluating, and making changes to management based on monitoring results. Acceptance of risk taking or the need to change management direction is a difficult pill to swallow in many agencies. Changing these agency cultures and public attitudes will be among the greatest hurdles to effective wildfire policy.

Acknowledgments

We greatly appreciate the comments of J. Cohen, D. DellaSala, and J. Furnish on earlier drafts of this manuscript. J. McGinley kindly prepared the figure.

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