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Fire Policy Frictions

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On the Cover:

The 2003 Encebado Fire approaches Taos Pueblo in northern New Mexico. In fire-adapted ecosystems, simply throwing more resources at fires might not be enough to protect the wildland/urban interface. Such fires suggest the need for a full understanding and respect for the ecological dynamics that shape the land we live in. See the articles by Jerry Williams and Jon Keeley beginning on page 4. Photo: Ignacio Peralta, Carson National Forest, Taos, NM, 2003.

The FIRE 21 symbol (shown below and on the cover) stands for the safe and effective use of wildland fire, now and throughout the 21st century. Its shape represents the fire triangle (oxygen, heat, and fuel). The three outer red triangles represent the basic functions of wildland fire organizations (planning, operations, and aviation management), and the three critical aspects of wildland fire management (prevention, suppression, and prescription). The black interior represents land affected by fire; the emerging green points symbolize the growth, restoration, and sustainability associated with fire-adapted ecosystems. The flame represents fire itself as an ever-present force in nature. For more information on FIRE 21 and the science, research, and innovative thinking behind it, contact Mike Apicello, National Interagency Fire Center, 208-387-5460.

Firefighter and public safety is our first priority.

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Reconciling Frictions in Policy To Sustain Fire-Dependent Ecosystems*

Jerry Williams

As a fireman, I am humbled to participate in your conference, because the American public has come to know Australian and New Zealand firefighters as good friends, willing to help in a time of need. We in the American fire services believe you to be among the most progressive and innovative wildland fire managers in the world. I want to especially thank you for the study tours, exchanges, and firefighting support that you have provided. These experiences have helped build fire professionalism in my country's ranks.

Thinking Outside the Box

On my last visit to Australia and New Zealand, as a member of the 1999 Study Tour, several of us found ourselves bouncing along in the back seat of a bus one day, and we began talking about the future of wildland fire management. We concluded that we've made a lot of progress in "operationalizing" the physical sciences of fire, but that we've got a long way to go with respect to the social and political sciences of fire.

It might not be the physical science of fire that limits our progress as much as our lack of understanding the social and political perspectives associated with wildland fire management. At a time when wildfire potential has never been greater, social expectations for protection have never been higher and political tolerance for failure has never been lower.

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Within the fire services, we are practiced at the operational level. Our seasoned professionals are comfortable in evaluating a wildfire and making the necessary tactical or strategic decisions. But we have paid little attention to factors on the land that might have set the stage for these kinds of tragedies.

Social and Political Factors

There has been intense scrutiny of Federal wildland fire policies—and for good reason: In 1994, we lost 14 firefighters in the South Canyon Fire; and in 2000, 235 homes were lost in the Cerro Grande escaped prescribed burn. Yet, in the fire services, we don't readily explore

Helitack crew member radioing for air support while the McNally Fire makes a run towards Jordan Hot Springs, CA. Despite highly effective fire services, the Western States are experiencing record and near-record fires such as McNally. Photo: David McCrea, USDA Forest Service, Arnold, CA, 2002.

When he gave the speech on which this article is based, Jerry Williams was national Director of Fire and Aviation Management for the USDA Forest Service, Washington Office, Washington, DC; now retired, he lives in Missoula, MT.

* The article is based on a speech by the author in October 2004 at the Australasian Fire Authorities Conference in Perth, Australia.

the social side of wildland fire policy, nor do we readily challenge public expectations for land management policies that might be setting the stage for high-risk, high-consequence wildfires. Until we do:

- Modifying fire policies or building additional suppression capacity won't make us much better;
- We won't reverse the trends toward larger, more costly, more destructive, and more dangerous wildfires; and
- We certainly won't reverse the deteriorated condition of fire-dependent forests, shrublands, and grasslands, which predisposes such dangerous trends.

Policies guide our decisions and actions. In broad terms, policies should help us deal with a pervasive, complex problem. But the time has come to move beyond fire policy alone and broaden our focus to include how we first manage the land and society's expectations for the land.

Forests in Crisis

The fire problem on national forest land is one of the major threats to sustainable land management. The problem is clearly related to the condition of fire-dependent forests and grasslands. With few exceptions, the problem is most acute in ecosystems with short fire return intervals, where missed fire cycles, past high-grading, and a history of overgrazing have put extensive parts of the arid West at risk. Although we successfully suppress 99 percent of our wildfires during initial attack, we are experiencing record costs, losses, and damages on the remaining 1 percent. This is often occurring in fire regimes where severe fires should be rare. Ecologists tell us that these forests are in decline. In my view, they are in crisis.

From Melbourne to Los Angeles, Canberra to Athens, Madrid to Missoula, Sydney to San Diego, and Banff to Boise, dangerous and damaging wildfires continue to capture national and even international headlines. Every year, we in the fire services answer with better trained firefighters, more modern equipment, and new technology. Every year, the scale and scope of uncharacteristically severe wildfires only grows.

> We are at a crossroads: We must look beyond our fire policies if we hope to protect fire-dependent forests and grasslands.

As wildland fire professionals, it is time to go beyond a policy of simply responding to ever more extensive wildfires with an ever larger suppression force. We are at a crossroads: We must look beyond our fire policies if we hope to protect fire-dependent forests and grasslands that are in such hazardous condition that people, natural resources, and ecosystems are at risk. Reducing wildfire costs, losses, and damages is going to mean acting on more than fire policies.

California Fire Siege

Let me draw on the October 2003 fire siege in southern California to illustrate the point.

In a single 10-day period, firefighters were hammered with more than 900 fire starts. Remarkably, only 14 of them became large incidents, which speaks to the capabilities of California's firefighters. But those 14 wildfires burned close to three-quarters of a million acres, destroyed 3,600 homes, and killed 24 people, including one firefighter. Suppression costs exceeded $200 million. Disruption to commerce was estimated at hundreds of millions of dollars. Damage to watersheds, roads, transmission lines, community infrastructure, and private property amounted to billions of dollars more.

These wildfires were significant for several reasons, but they were especially important from a policy perspective because they occurred in California. Let me offer a few facts:

- The combined operating budgets for wildfire preparedness in California across Federal, tribal, State, and local jurisdictions is more than $3 billion per year.
- The State has some of the most volatile fuel types anywhere in the world, and most are in a high-hazard condition.
- More than 35 million people live in California, and more are moving in all the time, putting tremendous pressure on development near wildlands.

With a $3 billion annual budget for wildfire preparedness, California fields the largest, most capable fire department in the United States, perhaps in the world. It has, by any measure, enormous firefighting capacity; but every few years, it is not enough. As strong as the fire services are in California, they are periodically overwhelmed by severe fires burning under extreme conditions—Bel Air (1961); Laguna (1970); Panorama (1980); Oakland Hills (1991); Malibu–Topanga (1993); and now southern California (2003).

Little Hazard Mitigation

Although the California landscape is dominated by volatile fuels, little is proactively planned or accomplished to mitigate the hazard at meaningful scales. The fires of October 2003 spread in areas where the land was being principally managed for things other than wildfire risk. We were managing these fire regimes for watershed values, endangered species habitat, visual quality, and homesites; but we were not managing these high-risk landscapes to mitigate wildfire risk at landscape scales. Mosaic or "patch" burning did little to reduce spread under extreme conditions.

From a policy perspective, we are putting enormous emphasis on managing the suppression response and on reducing fuels, but virtually no emphasis on reassessing resource goals that often exacerbate the land's inherent wildfire risk. We rarely manage the land in ways that are consistent with the dynamics of our most volatile fire regimes. In fact, I would argue that, often, we are unintentionally managing the resource *for* catastrophic fire.

In virtually every case where losses were greatest, the land management strategy to ensure watershed values, endangered species habitat, visual quality, and homesites called for preserving older chaparral or overstocked forests. Resource objectives called for late-seral stand conditions where large amounts of biomass dominated the landscape. Is it any wonder, in the southern California environment, where drought and Santa Ana winds are common, that the fire services would be overwhelmed when fuel buildups become so great?

Firefighters survey damage on the outskirts of Missoula, MT, from the Black Mountain 2 Fire in 2003. Photo: Keith Redington, Eldorado Interagency Hotshots, South Lake Tahoe, CA, 2003.

We are putting enormous emphasis on managing the suppression response, but little emphasis on reassessing the resource objectives that too often put the land at risk.

Homes Vulnerable to Loss

In terms of land use behaviors and growth trends in the wildland/urban interface, the California wildfires reveal another important policy question. Nearly all of the homes that burned in California in October 2003 were homes that, by virtue of their setting or their construction, were vulnerable to loss. They were vulnerable because brush clearances were inadequate and construction materials were combustible.

In many cases, homeowners were reluctant to adopt firewise practices. Perhaps tragically, the very attributes that people wanted on the landscape were the very factors that put them at risk. Unknowingly, the biomass that screened neighbors and provided a sense of privacy or seclusion were the very factors that put people at risk.

In contrast, communities that were saved or spared had enacted strict building codes and kept brush and fuel away from homes. In this sense, we have to ask, "Should our focus be on a policy 'owned' by the fire services, or should we focus instead on a policy that requires the attention of our political leaders and the communities they represent?"

The California wildfires in 2003 were the worst in the State's history, but other States share the same experience. A year earlier, the

Nearly all of the homes that burned in California in October 2003, by virtue of their setting or construction, were vulnerable to loss.

States of Arizona, Colorado, New Mexico, and Oregon had all suffered their worst wildfires on record. In both 2000 and 2002, the States of Idaho and Montana were plagued by summer-long wildfires. The large-fire problem in the United States pervades the West.

Policies Out of Step

You have to wonder why record wildfires continue. Despite enormous fire protection budgets, new technologies, a strong and well-trained workforce, and a very successful initial-attack success rate, overaccumulated biomass is fueling ever larger conflagrations. It is more than just fire policy that needs attention.

In the arid Western United States, our natural resource management policies and land use behaviors are often inconsistent with fire regime dynamics, leading to the conditions that fuel record wildfires. As long as this friction remains, we should anticipate ever larger, more destructive, more costly, and more dangerous wildfires. And, ironically, we might lose or damage the very values we are aiming to sustain.

Some might suggest that we should just let the fires burn but protect the houses. In the bargain, they might say, we would naturally reduce fuels and be money ahead. However, such an approach would overlook the ecologies involved in ecosystems with short fire return intervals. These ecosystems are adapted to low-severity burning, where species are maintained by fires that are relatively low and cool, not replaced by enormous fires that kill entire stands. They are adapted to burning conditions where nutrient, energy, and water cycles depend not on any kind of fire, but on the *right* kind of fire in terms of burning intensity, duration, and time of year.

The big fires of the past decade tell us something important. The condition of the ecosystems they burned in is the single most important causal factor, in terms of wildfire potential. Our ability to protect the people that live in these fire regimes, sustain the associated natural resources, control the costs of managing the associated fires, and ensure the safety of the firefighters called on to manage those fires depends on the condition of these fire-dependent ecosystems. Too often, we are managing them for the wrong condition.

Focus on Fuels Reduction

Instead of dealing with the underlying causal factors that predispose catastrophic fires or limit the effectiveness of firefighting operations, political energy is usually focused on fixing the fire services in the aftermath of a disaster. And we in the fire services too often encourage such political behaviors. More capacity and more apparatus are always welcome. But they are a false promise if we are remiss in managing the land and governing growth behaviors in the wildland/urban interface.

In the fire services, professionals know that suppression tools all have their limits. In fact, many of the perceived "best" tools are often the least effective because the conditions that contribute to extreme fire behavior limit their operational effectiveness. Wildfires simply outrun the best we can do with the best tools we have. But in the public perception, the bigger the fire, the bigger the suppression force that is needed.

The wildfire problem in the United States is not for want of firefighting capacity. Yes, some could use more or better equipment; but most of our units are well equipped. No, the wildfire problem in the United States can be traced to the condition of fire-dependent forests. In our high-hazard fire regimes, America's wildfire problem must be solved on the fuels front.

If we are truly serious about reducing suppression costs, losses, and damages, we need to get more serious, from a policy standpoint, about fuels reduction. But that cannot happen so long as treatments are constrained by short-sighted or contrary regulatory policies.

Policy Realignment

I am not against the Clean Air Act, the Endangered Species Act, or other environmental laws, but our regulatory policies must become better aligned with the dynamics of fire-prone ecosystems. Too many of our worst wildfires trace their underlying cause to the way we managed the vegetation. Ironically, in fire-dependent ecosystems, when we manage for clean air, wildlife habitat, and other values by managing for stasis, we inevitably put the very values we are managing for at risk.

Our fire suppression policies need to be predicated more directly on our fuels policies, and our fuels policies need to be more closely

aligned with our utilization policies and, perhaps, our energy policies. We are prescribe-burning more today than ever before, but it is expensive and contentious, and we lack the organizational capacity to do a whole lot more.

Yet, if we are going to get serious about reducing wildfire losses, we need to treat fuels at scales much larger than we are today. So long as the rate of fuels accumulation remains greater than the rate of treatment, overaccumulated biomass will continue to fuel severe wildfires that thwart our best efforts at control. One way is to create a demand for biomass that we otherwise cannot afford to dispose of. We need to more coherently establish markets for biomass—perhaps even if it takes guaranteed supplies, tax incentives, and consumer credits.

Nobody likes the thought of subsidies, but before we dismiss it, let's balance the cost against the suppression costs we're incurring, the property losses we're sustaining, the resource damage that is occurring, and the fact that there seems no end in sight. As a society, we are currently subsidizing a status quo that is broken. Wouldn't subsidies for fuels reduction be more cost-effective in the long run, with better long-term outcomes?

Public Lands Policy Debate

For decades, we have reviewed countless wildfires and had endless fire policy debates. However, we are only just beginning a public lands policy debate on how to sustain safe, resilient, and productive fire-dependent ecosystems.

A great gray owl, one of North America's largest owls, near the 2003 Slippery Rock Fire, Gallatin National Forest, MT. The owl inhabits a range of coniferous forests, foraging in openings and nesting in aspen, habitat types that require disturbances such as fire. Ironically, a policy bias toward stasis can reduce the very wildlife resources it is designed to protect. Photo: Jayson Coil, Sedona Fire District, Flagstaff, AZ, 2003.

Overcrowded forests adapted to low-intensity burning won't thrive if simply left to burn.

The USDA Forest Service has begun a new after-action wildfire review process that is going to further the natural resource management and land use debates that need to occur. Revealingly, many of our most problematic wildfires began incubating decades ago. The way the land has been managed for natural resources has a lot to do with how it might burn, especially in the short-interval fire regimes. The way the land has been used and developed has a lot to do with our ability to protect the communities that have grown there.

Under extreme burning conditions, the way the land has been managed and the way it has been developed have *everything* to do with our chances of protecting both natural resource values and people. Years ago, whether by design or by default, we began managing for stasis—for dense, overcrowded forests. When we began building homes in the midst of these forests, we set the stage for disaster.

Land Ethic Corollary

We all love the land, but we don't always understand or respect the ecological dynamics that shape it, define it, and sustain it. Perhaps Aldo Leopold's land ethic needs a corollary fire regime imperative—an ethical obligation and policy requirements to treat the land in ways consistent with the fire regimes that define the land.

We are beginning to understand the role of fire, but addressing the ecology of fire means more than just reintroducing fire when the opportunity presents itself. We must tailor our expectations for the land to the dynamics of the land. Our objectives for the resource must remain consistent with fire's role on the land.

In the United States, we boast a tremendous fire protection capacity. But firefighters shouldn't have to be heroes because we fail to manage the land in ways more consistent with the fire regimes that dominate our landscapes. ■

Lessons From the 2003 Fire Siege in California*

Jon E. Keeley

In October 2003, wildfires in southern California burned 742,000 acres (300,000 ha), destroying more than 3,000 homes and killing 26 people. It was the worst disaster ever to befall California, exceeding previous fires, earthquakes, and other natural disasters.

The fires gave reason for pause. Current wildland fire management policy is based on a philosophy that fuel management practices can reduce the ultimate size of wildland fires by creating fuel mosaics. Patches of young fuel, so the thinking goes, will act as barriers to fire spread. Did the fires in southern California bear the theory out?

Diverse Communities

The fires burned through various plant communities with very different responses to fire and fuel manipulation. Forests in the region—mainly long-needle pine types—have had their natural fire cycle of low-intensity surface fires interrupted by fire suppression policy, resulting in near fire exclusion. By October 2003, the accumulation of dead surface fuels and living ladder fuels had turned most of these forests into an extreme fire hazard.

The Paradise Fire near San Diego, one of 14 major conflagrations in southern California in October 2003. The vast majority of the landscape burned was dominated by shrublands in the stand replacement fire regime, such as those shown burning here. Photo: Keith Redington, Eldorado Interagency Hotshots, South Lake Tahoe, CA, 2003.

The vast majority of the landscape burned is dominated by chaparral, where periodic high-intensity crown fires are natural and unavoidable.

Luckily, soon after the fires reached these forests, the weather improved. The wind died down and rain eventually extinguished the fires. However, if the weather had not improved, a century of fire suppression and lack of fuels treatments in these forests could have added to the disaster. As it turned out, forests in the region comprised only about 5 percent of the total area burned.

The vast majority of the landscape that burned was dominated by chaparral and related shrublands. The natural fuel structure in these ecosystems leads to high-intensity crown fires. Unlike the adjacent pine forests, where fire suppression policy has been effective at excluding fires, in chaparral vigorous fire suppression has not resulted in fire exclusion, despite heroic firefighting efforts over the years. In fact, there is no evidence that reduced fuel loads in chaparral are an effective barrier to fire spread.

Worst Fire Climate

That's because southern California has the worst fire climate in the country. The October 2003 wildfires were fanned by Santa Ana winds

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* Based on J.E. Keeley, C.J. Fotheringham, and M.A. Moritz, "Lessons From the October 2003 Wildfires in Southern California," in *Journal of Forestry* 102(7) [October/November 2004]: 26–31.

that often reached speeds of 50 to 60 miles per hour (80–96 k/h). Under these conditions, firefighters were forced into defensive actions and could do very little to stop the conflagrations.

Fuel mosaics made little difference. Examination of stand age maps shows that much of the landscape that burned was a mosaic, with substantial patches of young fuels. But where high winds failed to push the fire through the young fuels, the fire either spread around them or jumped over them through fire brands lofted for a mile (1.6 km) or more. Under extreme weather conditions, there is overwhelming evidence that young fuels—even fuel breaks—will not prevent fire spread in southern California's shrublands.

Nevertheless, fuel reduction should remain an important management tool, even in chaparral shrublands, because it might lead to reduced fire intensity and increase the defensible space for firefighters. Fires driven by Santa Ana winds move extremely fast, and prefire fuel manipulation to create defensible space should be strategically applied, balancing potential benefits against the adverse impacts that fuel manipulation often has on natural resources. Although further economic study is needed, the most cost-effective fuel reduction would probably be in the wildland/urban interface.

Under extreme weather conditions, there is overwhelming evidence that fuel mosaics or even fuel breaks will not prevent fire spread in southern California's shrublands.

Management Implications

The massive fires of October 2003 in southern California were not unprecedented, and future fires of this magnitude are to be expected in shrubland landscapes. Though perhaps beneficial in the region's long-needle forest types, fuel reduction treatments would have done little to stop the spread of these fires because so much of the landscape is dominated by chaparral and related shrublands.

However, greater strategic use of prefire fuel manipulation in the wildland/urban interface might have reduced loss of lives and property during the southern California fire siege. Future development in the region should include planning for the high-intensity fire events that are natural to shrubland ecosystems, just as we take hazards from earthquakes and other natural catastrophes into account in our engineering plans. ■

Websites on Fire*

Forest Service Southwestern Region Photo Library

In wildland fire management, photos are often vital for illustrating a situation, technique, or technology. Yet fire managers often find themselves short of the photos they need to make a particular point or illustrate a given story or presentation. Internet photos abound, but usually in no particular order—useful for little more than random browsing—and almost always with a resolution size too low for some uses, particularly print publication.

That's why the photo library posted by the USDA Forest Service's Southwestern Region is so valuable. The photos are organized by widely recognized events and usable categories such as "Cerro Grande Fire (2 years later)" and "Success Stories." For example, the Rodeo–Chediski series, shot by noted Forest Service photographer Tom Iraci, illustrates articles by Paul Keller, a talented journalist and former hotshot. Many of the articles focus on treatments that kept Rodeo–Chediski from burning with uncharacteristic severity in historically open ponderosa pine forest. The articles are downloadable. Photos have short descriptions as well as thumbnails. Most are downloadable in both low- and high-resolution formats, depending on your purpose.

Found at
<http://fsweb.r3.fs.fed.us/pao/photo_library/index.html>

* Occasionally, *Fire Management Today* briefly describes Websites brought to our attention by the wildland fire community. Readers should not construe the description of these sites as in any way exhaustive or as an official endorsement by the USDA Forest Service. To have a Website described, contact the managing editor, Hutch Brown, at USDA Forest Service, Office of the Chief, Yates Building, 4th Floor Northwest, 201 14th Street, SW, Washington, DC 20024, 202-205-0878 (tel.), 202-205-1765 (fax), hutchbrown@fs.fed.us (e-mail).

Chaparral Fuel Modification: What Do We Know—and Need To Know?

Jon E. Keeley

Following the fires of 2003 in southern California, the San Diego Fire Recovery Network was formed to help local communities and landscapes recover from fire effects. At one of the Network's meetings, a poster was presented showing the perimeters of fires that did not overlap. The conclusion was drawn that fuel modification through prescription burning is a valuable management technique capable of preventing catastrophic wildfire losses. Similar analyses and conclusions have been published before for chaparral landscapes (Philpot 1974; Minnich 1998).

Counterexamples

However, interpreting the meaning of such static stand age maps raises many problems, including changes in weather not accounted for in interpreting the pattern and the fact that younger fuels are strategic sites for fire suppression forces to make a stand. Moreover, a careful evaluation of the literature shows that for every fire burning out at the perimeters of young fuel classes, there is a fire that didn't. For example:

- The 1971 Romero Fire near Santa Barbara, CA, burned about 14,600 acres (5,900 ha), nearly half of which were in 7-year-old fuels that regenerated following the 1964 Coyote Fire (Gomes and others 1993).

Evidence shows that for every fire burning out at the perimeters of young fuel classes, there is a fire that didn't.

- The 2003 Otay Fire southwest of San Diego burned about 44,000 acres (18,000 ha), nearly a quarter of which were in 7-year-old fuels. The 2003 Cedar Fire showed similar patterns (Keeley and others 2004).

Such conflicting examples have divided observers into different "camps," with people tending to choose sides. Unfortunately, science is left behind as each side's "experts" battle it out. It is worth understanding the basis for such differing observations. In particular, fire is not driven by a single factor such as fuels, but rather by multiple factors, the most critical of which is fuels in conjunction with weather and topography.

Differing Fire Behavior

Chaparral fires that ignite under moderate weather conditions behave differently from fires driven by severe Santa Ana winds. Under moderate conditions, a chaparral fire might well lay down upon reaching young fuels. However, the massive 2003 Cedar Fire clearly

A fuelbreak in southern California doubles as a hiking trail and as a corridor for the invasion of alien plants into wildland areas. Such treated areas can help firefighters stop chaparral fires ignited under moderate weather conditions, but they do nothing to stop fires driven by fierce Santa Ana winds, such as the fires of October 2003. Photo: Kyle Merriam, U.S. Geological Survey.

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showed that a even a landscape-scale mosaic of stand age classes, including many young stands—some from recent fuel manipulations—cannot stop a chaparral fire under severe weather conditions, at least not until the weather changes (Keeley and others 2004).

Recognizing these differences does not, in and of itself, dictate fuels management strategy in southern California. Even under severe weather conditions, younger chaparral fuels do reduce a fire's intensity, thereby increasing defensible space for firefighters. Strategic application of fuel treatments does have value, particularly in the wildland/urban interface (WUI). As the WUI expands and increases in complexity, the value of strategically placed fuel treatments will only grow as firefighters are forced to defend lives and property.

What about the fires that start under moderate weather conditions? Are landscape-scale fuel manipulations advisable to help control these fires? There is little doubt that some strategically placed fuel modifications in chaparral have reduced the ultimate size of some fires. For example, fuel breaks are anchor points for backfires that can stop wildfires from reaching urban areas. However, under the severe wind conditions characteristic of the most damaging fires in southern California, windows of opportunity for such a strategy are rapidly closed as firefighters are forced into defensive action near the WUI.

In most instances, fuel modifications in the WUI would seem to be more cost-effective than backcountry fuel breaks designed to help fight the region's least threatening fires.

Cost / Benefit Analysis Needed

Ultimately, a decision to conduct landscape-scale fuel manipulations in chaparral should be based on rigorous cost/benefit analysis (see, for example, Donovan and Rideout 2003). In most instances, fuel modifications in the WUI would seem to be more cost-effective than backcountry fuel breaks designed to help fight the region's least threatening fires.

Any such cost/benefit analysis should not be limited to fire-related considerations. It should also take nonfire resource management concerns into account. For example, landscape-scale fuel manipulations in chaparral can damage native plant communities and open the way for invasive plants (Keeley 2005). Such potential costs must go into the balance.

Additionally, the potential benefits of any landscape-scale fuel manipulation should be fairly weighed. Fires burning under moderate weather conditions are seldom lethal to people. The damage they do is less, by several orders of magnitude, than the damage done by a typical fire driven by Santa Ana winds.

Ultimately, a decision to conduct landscape-scale fuel manipulations in chaparral should be based on rigorous cost / benefit analysis.

Deciding the Debate

The debate over how to stop wildfire-related catastrophes in southern California is understandably emotional, but science can help. Evidence shows that fuels alone do not account for the region's most damaging fires, so fuel manipulations per se are not the solution. Although strategically placed fuel treatments can help firefighters protect lives and property, they must be in the right location. The region's land managers owe it to the people they serve to base their decisions on where to locate fuel manipulations—whether in the WUI or in the backcountry—on a full and fair cost/benefit analysis.

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The Effects of Fire on Rare Plants

Wayne Owen and Hutch Brown

From the 1988 Yellowstone Fires to the record-breaking fire seasons of 2000, 2002, and 2003, wildland fires have been making news. Lawmakers are concerned, Federal officials are concerned, and people living in forest communities are concerned. But should conservation biologists also be concerned?

Mistaken Impressions

There is no doubt that uncontrolled wildfires in forests that are congested with excessive fuel loads are very dangerous and have taken a heavy human and economic toll in recent years. However, fire intensity varies greatly, depending on many factors, and the effect of fire on forest communities and rare species might not always be immediately apparent.

Most concerns about the impact of fires on rare species have focused on plants. Most animals can move out of the way of an approaching fire and avoid its immediate effects, although they might suffer from its short-term impacts on their habitats. But plants are generally unable to escape.

However, does that mean that fire is bad for plants? As it turns out, in most cases it is not (fig. 1). It's time to correct some mistaken impressions about the overall impact of wildland fire on the biological resources of public lands.

Wayne Owen is the conservation planning biologist for the USDA Forest Service, Watershed, Fish, Wildlife, Air and Rare Plants Staff, Washington Office, Washington, DC; and Hutch Brown is the managing editor of Fire Management Today, *Forest Service, Washington Office, Washington, DC.*

Fire Effects Study

I classified the effects of fire on the 186 federally listed, proposed, and candidate plant species that are known or suspected on national forest land nationwide. I took the information primarily from documents prepared by the U.S. Department of the Interior's U.S. Fish and Wildlife Service; State natural heritage programs; and NatureServe reports. I classified the plants by fire response into four classes:

- Requires fire,
- Tolerates fire,
- Not affected by fire, and
- Adversely affected by fire.

Plants That Require Fire. Twenty-five percent (47 of 186) of all listed, proposed, and candidate plant species on national forest land

*American chaffseed (*Schwalbea americana*), native to the Southeastern United States and now endangered, requires fire to maintain the pine savannas and other open habitats it needs. Photo: USDA Forest Service.*

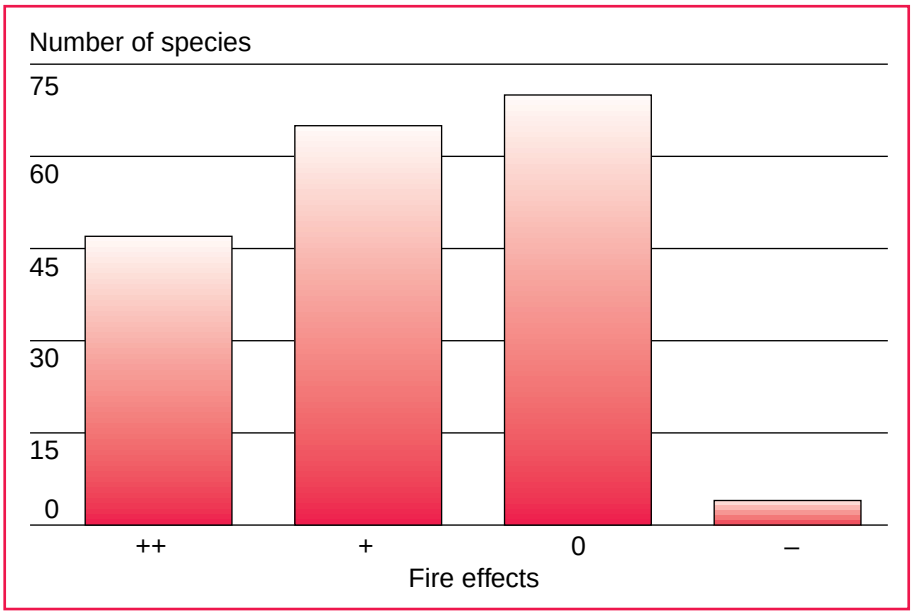

Figure 1—*Fire effects on listed, proposed, and candidate plant species on national forest land. ++ = plants that require fire to maintain their populations or requisite ecological conditions; + = plants that tolerate fire without adverse consequences for their populations; 0 = plants that are not affected by fire; – = plants that are adversely affected by fire. Total number is 186.*

actually require fire to maintain and sustain their native populations. In most cases, fire is necessary to maintain the ecological conditions that the plant requires to thrive. For example, smooth coneflower (*Echinacea laevigata*) requires frequent fires to maintain its preferred open-canopy habitat. Some rare insects, such as Fender's blue butterfly, depend on fire-dependent species such as the rare Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*).

Plants That Tolerate Fire. Thirty-five percent (65 of 186) of the plants on the list tolerate fires without long-term adverse impacts on their local populations. Some, such as Ute ladies'-tresses (*Spiranthes diluvialis*), occur in habitats that burn infrequently or at long intervals. Others, such as Winkler's cactus (*Pediocactus despainii*) are typically dormant during the primary fire season and are therefore usually not exposed to fire.

*Smooth coneflower (*Echinacea laevigata*), native to the Mid-Atlantic and Southern States, has been reduced to a few populations in Virginia and the Carolinas. It requires disturbances such as fire to reduce shade and competition from woody plants. Photo: USDA Forest Service.*

It's time to correct some mistaken impressions about the overall impact of wildland fire on the biological resources of public lands.

*Rare plants that tolerate fire include Sacramento prickly poppy (*Argemone pleiacantha *ssp.* pinnatisecta*) (left), native to New Mexico, and Ute lady's-tresses (*Spiranthes diuriales*) (right), found in parts of the Great Basin. Photo: USDA Forest Service.*

For many rare plants, fire is necessary to maintain the ecological conditions that the plants require to thrive.

Maguire primrose (Primula maguirei), *found in a single Utah canyon on moss-covered cliffs never visited by fire, is typical of plants unaffected by fire. Photo: USDA Forest Service.*

Plants Not Affected by Fire. Thirty-eight percent (70 of 186) of the plants studied are not affected by wildland fire at all. These plants typically occur in habitats that never experience fire. For example, aquatic plants like the mat-forming quillwort (*Isoetes tegetiformans*) never experience fire. Many plants live in habitats with so little plant life that there is essentially no fuel to carry a fire, including several desert species (such as *Astragalus desereticus*) and beach or dune species (such as *Cirsium pitcheri*). This group also includes several species in the tropical forests of the Caribbean National Forest, such as the el toro babyfoot orchid (*Lepanthes eltorensis*), that have never experienced a natural fire.

Plants Adversely Affected by Fire. Just 2 percent (4 of 186) of all listed, proposed, and candidate species on national forest land are actually harmed by fire. All four species occur in southern Appalachian old-growth forest. Two are rare trilliums (*Trillium persistens* and *T. reliquum*). The large-flowered skullcap (*Scutellaria montana*) is more immediately threatened by exotic species and by land conversion to urban uses. The exceptionally slow-growing rock gnome lichen (*Gymnoderma lineare*) is one of only two lichen species protected under the Endangered Species Act.

Fire Adaptation

The results are not surprising. Wildland fires are an integral part of so many landscapes on national forest land that the plants that evolved in them over thousands of years tend to be fire-adapted or even fire-dependent. And where fire is not normally a part of the ecosystem for lack of fuel—remembering that plants become fuel only under certain specific conditions—it poses no significant danger to rare plants. For more information, please contact Wayne Owen, USDA Forest Service, Mailstop 1121, 1400 Independence Ave., SW, Washington, DC 20250-1121, 202-205-1262 (phone), wowen@fs.fed.us (e-mail). ■

The Digi-Tall Complex: A Look at the Future?

Ken Frederick and Mike Benefield

Authors' note: *The following scenario is a fictitious account of what the revolution in information technology might mean for wildland fire suppression in the not-too-distant future. The story is based partly on reality, partly on our imagination. Ten years ago, it would have been pure science fiction; today, it isn't so far-fetched.*

Art Hickock was the fire behavior analyst on the type 1 incident management team assigned to the Digi-Tall Complex. The second morning on the assignment came early, and Art rolled out of his sleeping bag with just enough time to get a cup of coffee and a raisin bagel before the morning briefing. This was the second time he had gotten up this morning, he wryly thought while yawning.

The incident base camp was about 7 miles down the Tall River from the fire area. The main fire was burning near the confluence of Digi Creek and the Tall River, hence the fire's name. High up on the mountains above the main fire, two small spot fires, sparked by the same storm that had ignited the main fire, were slowly smoldering. These fires had been reconned, but no effort had been made to suppress them because they were small and burning within a wilderness area.

Ken Frederick is the public affairs officer for the USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ; and Mike Benefield is the fire management officer for the U.S. Department of the Interior, Bureau of Land Management, Central Oregon Fire Management, Rivers Division, Prineville, OR.

Morning Briefing

The briefing was typical, with each member of the command and general staff reviewing the work for the day ahead. The finance chief started by praising the local ranger district for smart preseason planning: Most needed agreements had been in place for a smooth transition to a type 1 organization.

Thanks to satellite video phones, radios were now strictly a tactical tool.

Satellite Communications. She was particularly grateful to the district for arranging a clear communications broadband from the local satellite communications provider. Thanks to satellite video phones, radios were now strictly a tactical tool. Supply orders for divisions and conversations about strategy were all done by satellite phone.

The logistics section chief noted that due to persistent vehicle shortages, a handful of crews would be riding school buses to drop points until better arrangements could be made. The school buses were lamentably slow due to poor road conditions. Art chuckled at the man's colorful rendition of what some of the bus drivers were saying about the roads. Given the tight national fire situation, the logistics section chief was searching the Internet for available transportation from the local National Guard or other military units. He quipped that motor pool sergeants were slow to answer their e-mail.

He also mentioned that problems with the bar code scanner would slow down checking out equipment from the supply cache until the scanner could be replaced from the local cache. Crew bosses would have to complete an old-fashioned checkout card for saws, pumps, tools, and handheld devices.

Radio Trigger Point Warnings. The communications section chief was next. After the standard messages about batteries, cloning, and where to best hit repeaters, he launched into rumors that the NOAA DATA Channel was out. The channel is a feature on King radios that uses integrated real-time weather data and global positioning systems (GPSs) to track the path of weather fronts as well as anomalies in wind and relative humidity. Whenever designated thresholds are reached, the King radio warns its wearer that fireline conditions have reached hazardous trigger points.

The communications section chief reassured everyone that they would be able to get the NOAA DATA Channel just fine. "The rumor started when a crew was doing some burnout near some powerlines on a fire in Utah last week,"

Based on integrated real-time weather data and other information, a radio warns its wearer that fireline conditions have reached hazardous trigger points.

he explained. "Their smoke column created some kind of weird electromagnetic dynamic with the powerlines, and that interfered with the NOAA alarm coming over their radios."

He added that the communications experts at the National Interagency Fire Center in Boise, ID, were looking into what happened. "But it should not affect us in the least," he declared. There were no powerlines anywhere near the Digi-Tall Complex.

Satellite Photos. The plans chief reported that the FIRESAT satellite pass at 4 a.m. had yielded beautiful, real-time infrared photos of the fire, with pinpointed locations of assigned resources.

However, the situation unit leader said she had run into problems downloading several geographic information system layers from the server on the local national forest. As soon as the downloads were completed, she said, she would digitally overlay the topographical map, the vegetation-type layers, assigned resources, and the infrared image to display an accurate picture of the fire.

Art already knew this, since he had spoken with her at about 4:15 a.m. The two had spent several minutes looking at the satellite images e-mailed moments after the satellite made its pass.

Fire Behavior Animations. The plans chief then asked Art to summarize the fire behavior expected for the day. Art recounted what he knew of the fuels on the fire's head and its active flanks. On a screen, he projected fire behavior animations for the burning period, noting the threat of short-range spotting after the morning inversion layer broke up.

He then reviewed the weather forecast and mentioned an e-mail from the National Weather Service showing the possibility of a weak cold front moving through the area. Projecting the e-mailed weather map onto the screen, Art made eye contact with the division supervisors and crew bosses to make sure they registered this possibility.

At this point, the situation unit leader spoke up again. An eagerly anticipated order had come in overnight. The team now had two remote video Webcams, to be set up overlooking each of the wilderness fires. Powered by solar panels (with a 12-volt battery backup), they would transmit real-time video images 24 hours per day, along with weather data via satellite. The video would be streamed to the remote incident command post Website and displayed at all briefings.

With irony in his voice, the plans chief added that they were still awaiting arrival of a "field" observer, who would sit at a terminal to monitor and evaluate the behavior of the two wilderness fires via Internet. He also reminded everyone to keep their unit logs current and e-mailed to the documentation unit leader using their personal data assistants.

Working Over the Web. The incident information officer remarked that the second webmaster she had requested had checked in at the camp overnight. With two webmasters and two assistant incident information officers, she now felt adequately staffed for the assignment. She also reported that the complex's Website was up and running and had already received 2,388 hits. Because the fires in the complex were somewhat remote, she did not expect many visitors from the media. Most of her shop's work would be done over the Internet.

She then reminded the division supervisors to take their digital cameras with audio out onto the

Webcams monitor remote fires, transmitting real-time video images 24 hours per day.

fireline that day and uplink their photos with embedded audioclip files from the cameras at the end of the shift. She concluded with her trademark statement: "We can never have too many digital photos."

Everyone chuckled. The team's information officer was well known for amassing hundreds of digital photos from certain fires. Her home unit hosted a massive fire image library, in partnership with a nearby university.

The documentation unit leader added, "We can never have enough documentation, either, so make sure that your cameras are in the audio mode during important tactical operations. Provide accurate

narration and watch your language."

Video Phone Briefing. The operations section chief then reviewed the objectives planned for the day and went over division assignments. As the real-time video phone interview with Division Bravo revealed, the head of the fire was in a thickly wooded draw where three hotshot crews would be working. The Redwood Hotshots were on night shift, and their superintendent was cued up by Division Bravo and asked to brief the day shift crews. He used his satellite video phone to transmit real-time footage of the situation and of several specific hazards in the area.

The corner of the projection screen used for the briefing included a topographic map with a blinking cursor showing the superintendent's real-time location. The operations section chief added that the division supervisor with responsibility for the draw would need to coordinate closely with the hotshot crew superintendents to pinpoint the area of most intense burning at the fire's head. This would be important information for the effective use of fire retardant, planned during the middle and late portions of the burning period.

Drone Aircraft. Next came the air operations branch director. He said that aerial drone A–7 was already up for its daily reconnaissance flight and was looking for natural barriers for anchoring firelines.

With its onboard satellite transmitter, tactical radio repeater, GPS, video camera, and weather instruments, the drone is ideal for mapping and providing real-time aerial imagery. The incident meteorologist also noted that A–7 had confirmed weather soundings with regard to wind direction and velocity at the 5,000-foot (1,524-m) level.

The air operations branch director added that the previous day's retardant coverage levels and placement had proved effective, as confirmed by the postdrop reconnaissance provided by the drone. Drone A–7 was the very same aircraft credited with alerting a fire crew in the summer of 2011 to a spot fire below the crew. The drone directed the crew to the nearest safety zone just in the nick of time.

Operating the Drone. Fire suppression drones are "piloted" by an aerial platform operator (APO), now a red-carded position assigned to the air operations branch. The APO operates in a niche once occupied by the air tactical group supervisor.

A 7-foot aerial drone operated from the back of a pickup truck is ideal for mapping and providing real-time aerial imagery.

The APO works closely with both air and ground operations, usually from the tailgate of a pickup truck parked at the intersection of an improved road serving as a runway for the 7-foot (2.1-m) drone. Using the drone's navigational camera, GPS, and a joystick, the APO pilots the craft from takeoff to landing. "It's kind of like playing the video game *Galactic Warrior* when I was a kid," joked the Digi-Tall Complex's APO from the back of the briefing tent.

The safety officer then took the floor to remind everyone about lookouts, communications, escape routes, and safety zones and to maintain good footing on the steep slopes.

Wildland Fire Use. The incident commander stepped forward to announce that the local ranger district had given the green light to manage the two wilderness fires as wildland fire use fires. Fire use is no longer considered a separate management activity from suppression. As long as the two ignitions met the appropriate criteria in the local fire management plan, their management could be seamlessly integrated into the team's suppression activities on the larger fire.

The incident commander also covered a few mundane topics, then asked if there were any questions. He wrapped up the briefing by encouraging everyone to keep up the good work. The main fire was already looking remarkably good, even though this was only the team's second shift, and continued good work over the next 4 to 5 days would catch it at under 800 acres (320 ha).

After the briefing, the incident information officer approached Art with a favor. "We have a local radio station reporter coming out today, and he wants to do a story on fire behavior," she said. "Would you have time to go out with this guy and explain stuff to him?" Art consented.

On the Fireline

The reporter arrived at 10:30 a.m. After outfitting him with safety gear and briefing him on the fire, Art drove the reporter and one of the assistant incident information officers to the fireline. Upon arriving at drop point 4, he notified the

division supervisor by radio that they were on her division.

Then they began hiking up the line, stopping now and then to chat with squads who were improving sections of the line and holding it where fuel between the line and the fire had been burned out. The reporter captured sound bites on a digital audio recorder and snapped a series of digital photos.

Laser-Guided Retardant Drops. A short while later, they ran into the division supervisor. "You're just in time," she said. "The fire has been threatening a run up the draw, so we went ahead and ordered retardant." Art had already explained to the reporter how the Laser-Guided Retardant System worked. The LaGR—pronounced lager, as in German beer—System uses technology originally developed for the military to enable retardant bomber pilots to place retardant with far greater precision than was previously possible.

A single resource known as a laser targeter chooses a spot with a clear view of a theater of the fire where retardant will be used. Using a tripod-mounted laser affixed to a spotting scope, the targeter projects a spot of laser light at the starting point for the retardant drop. The laser is effective for up to 2 miles (3.2 km). Pilots as well as operations section chiefs have found that effective placement of the laser spot depends on having a knowledgeable targeter coordinating closely with a knowledgeable ground contact, usually a division supervisor or a good crew boss.

This laser spot on the ground is detected and tracked by a special camera mounted in the nose of the aircraft. The laser spot creates a highly accurate, fixed point on the ground that precisely defines where the drop is needed. The pilot determines the direction the drop will go by balancing the realities of the terrain he or she flies over with a vector suggested by the ground contact.

Laser-guided retardant drops have dramatically improved air tanker performance.

Less Guesswork. Operated by the copilot, a computer on the aircraft uses the laser spot as a trigger point for where and when to initiate the drop. In addition to the laser spot, the computer uses a set of additional inputs to configure the drop, including wind data; topography; and the aircraft's speed, above-ground altitude, and rate of climb or descent. Some of these data come from instrumentation on the aircraft, others from inputs by the copilot.

The laser spot takes most of the guessing out of where to place retardant drops. After the computer knows where to start the drop, it factors in all the other variables to achieve both safety and drop effectiveness. The door-opening sequence is programmed by the copilot, depending on whether a trail drop or salvo is desired. The overall result is a dramatic improvement in the effectiveness of retardant drops.

Improved Air Tanker. Eight minutes later, the latest version of the Firetruck–295 rumbled around the fire a couple of times as the pilots sized up approach and egress corridors and programmed their onboard LaGR computer. Art and the reporter listened as a hotshot crew superintendent discussed the fire's behavior, winds at the surface, and the tree canopy over the video phone with the bomber pilot. The pilot validated the LaGR coordinates against the hotshot superintendent's tactical plan, and drone A–7 magnified the drop zone to reveal that the last of the hotshots were clearing out of the "predicted affected coverage area."

A moment later, the ship executed a near-perfect salvo drop right across the head of the fire and slightly up a draw. "Great drop, tanker 4–4," intoned the superintendent. "That was a slug to the midsection. We'd like one or two more loads." The bomber pilot replied "I can bring you water out of Lucky Lake—ETA 15 [estimated time of arrival 15 minutes], or go back to the barn and get some more mud—ETA 45. What is your desire, superintendent 34?"

Replacing most of the antiquated C–130s, the Firetruck–295 was built specifically for the demands associated with the aerial delivery of water or retardant. Driven by two high-powered turbo props, the air tanker carries 2,200 gallons (8,327 L) of retardant and/or water. Its short takeoff-and-landing envelope allows it to use most remote runways that can support its weight. It has the capacity to fill by scooping out of lakes within distances as small as 1.5 miles (2.4 km).

Multimedia Reporting

The reporter was fascinated by all this, remarking that he could now get two stories from the trip. Back at base camp, he set up his laptop and began to write the stories.

As soon as he had a draft, he downloaded several audio files from his digital audio recorder into the laptop, then e-mailed the script and audio files to his station's newsroom. There, other station personnel would polish the story and insert the audio clips into a story for broadcast.

Next, the reporter downloaded his digital photos, quickly reviewed them, and chose the best five or six images, typing in cut lines. These he e-mailed to the station, where they would be posted on the station's Website, along with the script of the story.

Noting the reporter's skill with photos and text, Art jokingly asked him whether he was sure he was just a radio reporter. The reporter smiled.

"Radio news is different than it was 6 or 8 years ago," he said. "We market immediacy, and the Internet has changed the definition of that term. So we broadcast news and we post text and photos on our Website.

"Actually, if we get a good story, we sell it to wire services and generate a little more revenue for the station. This LaGR story will sell in a flash."

Fingerprint Readers

Art walked away, and it occurred to him that he was hungry. He went into the food and refreshment tent, ordered a mocha/almond latte, and checked out the pizzas, sandwiches, fruits, and other snacks.

> Fingerprint readers track resources from dispatch to demobilization.

Still hungrily eying the food, Art walked over to the food unit's PrintReader Module. Fingerprint readers are now standard for tracking resources from dispatch to demobilization. At the beginning and end of each shift, firefighters file past multiple fingerprint readers, which automatically record time on electronic data-recording devices. The data are then routed through payroll.

Art pressed his thumb to the PrintReader scanner, which recognized his thumbprint in a split second and issued a paper plate. "The smoked turkey with avocados on sourdough sure looked good," Art thought with a smile.

Acknowledgments

The authors would like to acknowledge contributions to this article from Carl Beyerhelm, a geographic information systems specialist for the USDA Forest Service, Coconino National Forest, Flagstaff, AZ; and Allen Farnsworth, a fire mitigation and education specialist for the Bureau of Land Management, San Juan Public Lands Center, Durango, CO. ■

Los Alamos Project: Reducing Fire Hazards in the Wildland/Urban Interface

Susan DiMauro-Roeser

In May 2000, the Cerro Grande Fire swept through the small New Mexico town of Los Alamos, forcing the evacuation of about 18,000 residents.* The fire started as a prescribed burn by the U.S. Department of the Interior National Park Service on Bandelier National Monument, a few miles away. By the time it was contained, the damage estimates were devastating:

- About 47,000 acres were burned;
- 112 structures at the Los Alamos National Laboratory were destroyed; and
- 239 homes were reduced to ashes, displacing 403 families.

Thankfully, no lives were lost.

First Recovery Steps

Even before the fire was completely contained, Congress passed a resolution recognizing the Federal Government's liability for starting the fire. Not long afterward, the Cerro Grande Fire Assistance Act (CGFAA) was passed by Congress and signed by the President.

On March 13, 2001, the Los Alamos County Council approved the Los Alamos County Long-Term Recovery, Redevelopment and Hazard Mitigation Plan. Under the CGFAA's guiding principle of mitigation compensation, the plan addressed long-term recovery and redevelopment needs within Los Alamos County.

One of the 13 mitigation measures listed in the plan created a Mitigation Program for Unburned Property Owners, later renamed the Los Alamos County Defensible Space Project. The Office of Cerro Grande Fire Claims, an arm of the Federal Emergency Management Agency (FEMA), provided $6.5 million in funding to reduce the risk to homes from future wildfires. The project was completed with $5.9 million, and remaining funds were allocated to other mitigation projects in the county.

The Defensible Space Project was designed to thin and remove hazardous fuels near residences, giving firefighters more room to stop a blaze and protect the community.

Creating Defensible Space

The Defensible Space Project was designed to thin and remove hazardous fuels near residences, giving firefighters more room to stop a blaze and protect the community. In recent years, drought and extreme fire danger levels have made defensible space work a critical part of landscaping in Los Alamos and elsewhere throughout New Mexico and the West.

"We needed to change fundamental forest management policies and implement what we had learned," said Los Alamos Fire Chief Douglas R. MacDonald. "Those lessons came too late for survivors of the wildfires of 2000. I can only hope it will not be too late for those folks who will experience wildfires in the future."

A team of local officials, including the Los Alamos County Council; Chief MacDonald and other fire department personnel; the FEMA authorized agent; and the project management contractor, P.A. Smith Concepts & Designs, Inc., set the project's mission and goals. The team identified the project's criteria for participation and developed an implementation strategy.

Project Commitments

Specifically, the Defensible Space Project was committed to:

- Developing an extensive public outreach program to attract high levels of participation in the voluntary project;
- Informing property owners, community members, and others in the county of the benefits of defensible space and teaching them steps they can take to protect their properties;

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* For more on the fire and evacuation, see Jim Paxon, "'Remember Los Alamos': The Cerro Grande Fire" (*Fire Management Today* 60[4]: 9–14).

- Furnishing managers to coordinate the work, ensure that the project was running on schedule and within budget, accomplish the project's mission, and keep the community informed of progress;
- Planning for defensible space by contacting each eligible property owner, assessing properties, and creating a defensible space property plan for each participant; and
- Conducting mitigation work according to each property plan.

On August 13, 2002, Chief MacDonald presented the Los Alamos County Defensible Space Project Plan to the Los Alamos County Council for final approval. The council unanimously approved the plan.

Cooperation a Key Goal

Davey Resource Group, a division of the Ohio-based Davey Tree Expert Company, was hired to implement the public information and involvement plan developed by the county's public information officer and project officials. Together with the project team, the company developed a comprehensive outreach program, including a logo, neighborhood informational events, education in the schools, and more.

Eligibility was based on a property's tree densities, its slopes, and its location relative to high wind paths that favor the spread of fire.

George Geissler, the consulting forester for the project, determined that 2,752 properties in the Los Alamos townsite needed defensible space work. Another risk assessment found that 650 properties in nearby White Rock were also eligible. Eligibility was based on a property's tree densities, its slopes, and its location relative to high wind paths that favor the spread of fire.

Most families in Los Alamos live on a third of an acre (0.1 ha) or less, often bordering dense wildland vegetation. Under the project, typical guidelines focused on removing fuels within 30 feet (9 m) of a home. The 30-foot (9-m) zone often includes not only the lot in question, but also adjacent properties, requiring cooperation among property owners to protect the neighborhood as a whole.

"Cooperation of neighboring property owners was imperative because defensible space is a community goal," noted Geissler.

High Participation

The project's success depended on very high participation. At the beginning of 2003, planners began meeting with targeted homeowners to make individual property assessments and defensible space plans. The plans were limited to thinning and vegetation removal, although planners also recommended other steps, such as installing class-A roofing.

During these one-on-one meetings, the planners answered questions and addressed any misconceptions or concerns. Organizers learned that property owners were much more likely to participate when they fully understood the issues and felt comfortable with what was expected of them. Nearly every property owner who received specific, personalized information agreed to have mitigation work done around his or her home. Thanks to strong outreach, 70 percent of those eligible eventually participated.

Scott Wheaton, a defensible-space planner for the Los Alamos County Defensible Space Project, confers with a homeowner while assessing a property in Los Alamos, NM, for fire hazards. Photo: Elaine Mattern, Davey Resource Group, Los Alamos, NM, 2003.

Defensible-space planners in Los Alamos, NM, recommended moving firewood and other flammable materials away from homes. Photo: Elaine Mattern, Davey Resource Group, Los Alamos, NM, 2003.

Project Implementation

Baca's Trees, Inc., and Trees, Inc., joined the defensible space team to complete the mitigation work. By the close of 2003, the project had helped protect more than 2,300 properties, and messages about defensible space reached thousands of residents across the county.

"My backyard … had approximately 30 mature ponderosas on a third of an acre," said one participant. "For several years, I have routinely removed excess litter from the ground. However, the trees were so large and so closely spaced that I could not do any thinning myself.

"The defensible space crew removed five large trees—rapidly, neatly, professionally. That left my forest with sufficient openings that I could selectively drop other trees myself. I have removed about six additional trees, and I will gradually remove more. …

"Thanks for the Defensible Space Project. It enabled me to do the continuing job myself."

> Nearly every property owner who received specific, personalized information agreed to have mitigation work done around his or her home.

Project Success

Success was palpable. The National Fire Protection Association (NFPA) has a point-based scale for measuring the risk of wildfire to communities (NFPA 1144, Standard for Protection of Life and Property from Wildfire, 2002 edition). On the scale, average wildfire risk fell from 105 to 88 points for Los Alamos and from 81 to 51 points for White Rock.

That's a remarkable improvement. Some conditions in the wildland/urban interface cannot easily be changed, such as the location of a structure, the topography of an area, or fire weather conditions. Communities such as Los Alamos and White Rock are therefore limited in how much they can improve their situation.

The lowest possible wildfire hazard rating is 77 points for Los Alamos and 31 points for White Rock. The Defensible Space Project reduced the hazard rating for both communities by 60 percent of the total possible reduction.

Project Followup

Although project planning and implementation are now over, property owners across Los Alamos County are being encouraged to continue making their properties defensible for wildland firefighters. Participants signed a contract promising to maintain defensible space for at least 5 years. They can continue to get landscaping tips and other information from the project's public information officer and on the project Website at <http://www.lac-defensiblespace.us>. For more information on the project, contact Susan DiMauro-Roeser, 505-681-2358 (voice), sdimauro@davey.com (e-mail). ■

The Big Blowup's Impact on an Idaho Town*

Ron Roizen and Jim See

In 1910, the Idaho mining town of Wallace was served by a weekly newspaper called The Wallace Miner. *Its motto: "Devoted to the best interests of the entire Coeur d'Alene district, giving only authentic information and aiming to accomplish this without fear or favor."*

*On August 25, the paper's front-page story announced, in big, bold letters, that "**FIFTY LOSE LIVES IN FOREST FIRES THROUGH DISTRICT**." The actual number killed in the fires now known as the Big Blowup, which had hit the Northern Rockies 5 days earlier, would later prove closer to 90.*

The story placed the number of men in Ed Pulaski's crew who survived the night in the Nicholson Mine at 31, a figure later revised to 39. Despite such problems, The Miner *offered a gripping and detailed account of the fire's encounter with Wallace, reprinted below.*

Town Seemed Doomed

For weeks the forests in every direction have been burning, and it was known that only a heavy fall of rain would ultimately put them out. With a high and fitful wind Saturday afternoon and evening, the flames headed for the south toward Wallace, and for a time the entire town seemed doomed. Arrangements were quickly made to get the women and children to places of safety. The railroad companies assembled their locomotives and rolling stock preparatory to caring for everyone. Nestled in the heart of high surrounding hills, with egress limited to a narrow canyon, it was realized that it might become necessary for all to flee, as a general conflagration would mean certain death for any who remained.

As the flames neared town on the southwest, they followed the hillside on the south, and for a time it looked as if the town might escape.

Nestled in the heart of high surrounding hills, with egress limited to a narrow canyon, Wallace seemed doomed to destruction.

Suddenly a sheet of flame, which appeared to be a hundred yards long, burst a hundred feet high into the sky, and it was only too apparent that the danger was graver than ever. Within a short time a brand from this lighted on a framed building and started the fire in town. The hills on the opposite side

The Sunset Brewery building in Wallace, ID, following the Big Blowup of 1910. Photo: Courtesy of the Barnard-Stockbridge Collection (8–C04d), University of Idaho, Archives and Special Collections.

Ron Roizen is the executive director and Jim See is the president of the Pulaski Project, Wallace, ID.

* The article first appeared in the *Shoshone News-Press* on October 23, 2004.

Destruction at the eastern end of Wallace, ID, following the Big Blowup of 1910. Photo: Courtesy of the Barnard-Stockbridge Collection (8–X0545d), University of Idaho, Archives and Special Collections.

> The hills on the opposite side of the city then took fire, and on the south side the main hill was burning in 20 places.

of the city then took fire, and on the south side the main hill was burning in 20 places. The residences on this hill took fire and were quickly demolished. It seemed as if the town could not be saved, but after several hours of valiant effort by the fire department, assisted by a large force of volunteers, the flames were stayed, and the damage is variously estimated at from $500,000 to $1,000,000, the actual figures being probably somewhere near $800,000.

Among the destroyed buildings are the Coeur d'Alene Ironworks, Sunset Brewery, Coeur d'Alene Hardware Company's warehouse, Worstell Company's Furniture Store, O.R. & N. station, Corner and Fisher's office and warehouses, Wallace Times, Wallace Cigar company, Turner Music Company, Pacific Hotel, Pacific Annex, several rooming houses and a large number of dwellings.

For a time it was feared the Providence Hospital and the Standard and Mammoth mills were destroyed, but they remained uninjured. The fire followed the hills to Mullan and Burke, and grave fears for both these towns were entertained. The damage will not be great in either place.

No Panic

In an editorial titled "Our Calamity," The Miner *defended the town from the charge in a competing newspaper of a panicked reaction to the fire:*

While we regard this as no time for denunciation, we cannot refrain from criticising [sic] the *Spokesman-Review* for an article in its issue of Tuesday morning, which starts by saying 'we have passed the first stage of wild, unreasoning panic.' This was written by a special correspondent sent in here after the fire had been controlled and consequently ignorant of the circumstances. There was no panic, wild or otherwise, and never was more reason displayed in an emergency. Every able bodied [sic] man was active, going from one point of danger to another, to be of assistance to the best of his ability.

Acknowledgment

Thanks are due to Bernie Ludwig, librarian at the Wallace Public Library in Wallace, ID, for her generous help in preparing this article. ■

An Updated Rate-of-Spread Clock

Jeremy Kolaks, Keith Grabner, George Hartman, Bruce E. Cutter, and Edward F. Loewenstein

Several years ago, Blank and Simard (1983) described an electronic timer, frequently referred to as a rate-of-spread (ROS) clock—a relatively simple instrument used in measuring fire spread. Although other techniques for measuring rate of spread are available (such as data loggers), the basic ROS clock remains a valuable and relatively inexpensive tool. However, several items described in the original article have changed. Therefore, we are describing an updated version of the ROS clock.

Project Need

In 2003, we needed several hundred ROS clocks to complete a fuel loading project funded by the Joint Fire Science Project. Although the original ROS clock would have worked, several technological advances and changes in product availability have occurred that allowed or required a modification in design (Grabner 1996). We changed the electronic circuitry and used plastic piping for the enclosure.

Technological advances and changes in product availability allow or require a modification in design.

Grabner (1996) used one removable 3-volt battery instead of two 1.4-volt hearing-aid batteries, as shown in the original schematic. The removable battery also eliminated the need for a switch and allowed very easy replacement when the batteries got low. Grabner did have trouble with clock failure due to low battery voltage. However, we have found that the addition of a 470,000-ohm resistor between the transistor and the clock provided a more stable, longer lasting voltage supply (fig. 1).

New Clock Design

The original ROS clock was contained in thin-walled copper tubing three-quarters of an inch (1.9 cm) thick, with a cap soldered to one end. The original also used thermocouple wire for the exposed leads. We substituted schedule 40 PVC plumbing pipe and fittings for the copper tubing and caps. One end cap was glued in place using the appropriate solvent adhesive and the other end was fitted with a threaded end cap (fig. 2). We used

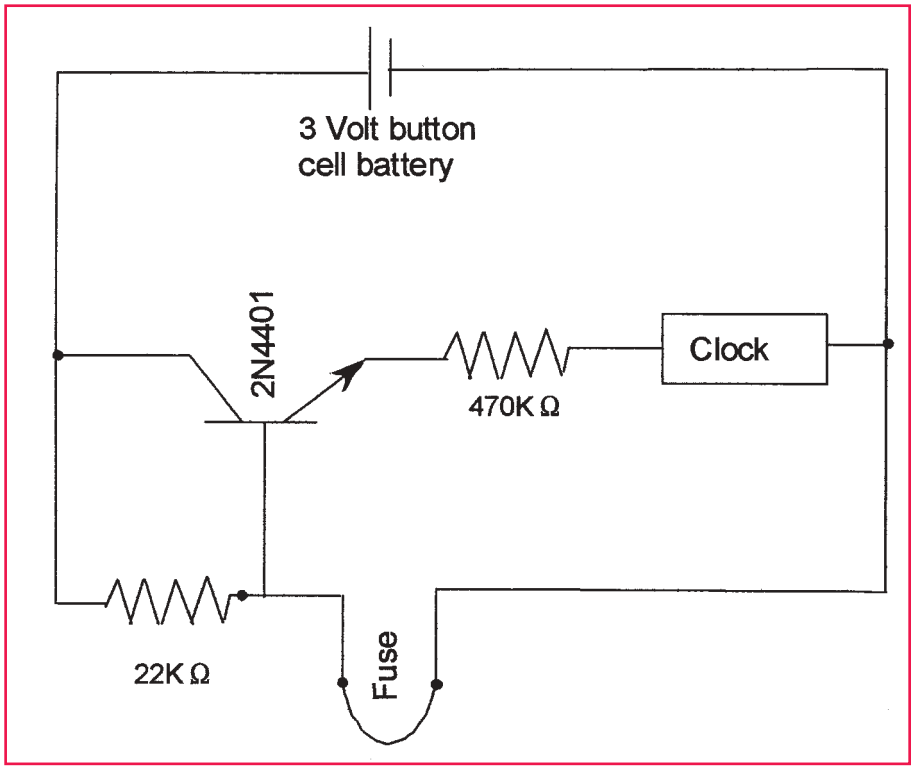

Figure 1—*Schematic diagram of the updated electronic timer.*

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Figure 2—*The updated rate-of-spread clock is both useful and inexpensive, with parts that are easy to find. Photo: Keith Grabner, U.S. Geological Survey, Columbia, MO, 2004.*

Parts Needed*

- 22K Ω 1/4 w resistor (Radio Shack part no. 271-1339)
- 470K Ω 1/2 w resistor (Radio Shack part no. 271-1133)
- 2N4401 NPN silicon transistor (Radio Shack part no. 276-2058)
- 3.0 v lithium button cell battery (Radio Shack part no. 23-162)
- Button cell battery holder (Radio Shack part no. BH-32)
- Circuitboard
- Wire
- PVC schedule 40 1-inch (inside diameter) pipe, cut into 3-inch lengths
- PVC schedule 40 1-inch cap
- PVC schedule 40 1-1/4-inch x 1-inch adapter, male, reducing, MIPT x socket
- PVC schedule 40 1-1/4-inch screw-on cap
- Digital sports watch

* Catalog/part numbers for one vendor are shown for convenience. The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement of any product or service by the U.S. Department of Agriculture. Individual authors are responsible for the technical accuracy of the material presented in *Fire Management Today*.

silicone sealant to moisture-proof the fittings, although we highly recommend removing the clocks from the ground as soon as possible so that torrential rains do not cause malfunctions. We also found that regular electrical wire was adequate for the leads. The fusible link shown in figure 1 was simply a solder connection.

The electronic parts and wire were readily available at a local electronic parts store. The most difficult parts to obtain were enough digital sports watches. The watches we used ran most reliably at a level of 1.8 volts. The total cost of materials for the updated version was slightly more than $6 each in 2003.

Acknowledgments

The authors wish to thank John Roberts, a retired senior research analyst, and Milon George, an associate professor of forestry, University of Missouri–Columbia, for their assistance in redesigning the clock's circuitry.

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Ecological Restoration in Montana's Western Larch

Hutch Brown

Federal land management has shifted focus in recent decades. In 1992, the USDA Forest Service embraced a policy of ecosystem-based management (Robertson 1992; Salwasser and Pfister 1993), and in subsequent years Federal land managers formulated corresponding policies for wildland fire management (IFWFPRWG 2001). The Forest Service's one-time focus on timber production and fire exclusion is past; the agency's main concerns today are ecological restoration and outdoor recreation (Bosworth 2004).

The goal of ecological restoration is to restore degraded ecosystems to a semblance of their presettlement condition (see the sidebar). In the Interior West, much of the restoration focus has been on relatively dry forest types, particularly ponderosa pine (Friederici 2003). In the nonlethal fire regime typical of such forests, land managers can often align their ecological goals with their social and economic objectives. For example, restoring open ponderosa pine forest can improve wildlife habitat while reducing fire hazards and generating jobs. By contrast, in ecosystems such as chaparral—where fire severities were historically much higher—land managers might face difficult tradeoffs between protecting the wildland/urban interface and restoring presettlement conditions.

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Restoration treatments can be ecologically as well as socially and economically beneficial.

Fortunately, such tradeoffs aren't always inevitable, even in the mixed-severity and stand replacement fire regimes (Arno and Fiedler 2005). The tiny Montana community of Seeley Lake offers an example of people working together to align ecological goals with social and economic concerns.

Seeley Lake

Seeley Lake is nestled between wilderness areas on national forest land in northwestern Montana. Carved by glaciers eons ago, the Seeley Valley contains a chain of lakes fed by the Clearwater River, which flows south to join the Blackfoot River, made famous by Norman Maclean's tale "A River Runs Through It." Traversed by scenic Highway 83, the "chain-of-lakes" corridor is important for recreation. Seeley Lake in particular has campgrounds (fig. 1) and hundreds of homes and summer cabins scattered in the forests surrounding the lake.

In 1988, the 247,000-acre (99,000-ha) Canyon Creek Fire roared out of the Scapegoat Wilderness into a relatively remote area northeast of Seeley Lake, destroying ranch houses and cattle. The fire was initially managed for wildland fire use, but it quickly escaped the wilderness boundaries. Managers of the Seeley Lake Ranger District on the Lolo National Forest worried that a similar large fire could sweep through the narrow, densely forested recreation corridor, threatening lives and homes around Seeley Lake (Arno and Fiedler 2005). In fact, a large stand replacement fire in 2003 blackened parts of the adjacent Swan Valley some 25 miles (40 km) to the north, narrowly missing homes in and around Condon, MT.

But before planning fuels treatments, district managers wanted to know what the forests around Seeley Lake originally looked like and what role fire played in them. They asked for help from researchers at the Fire Sciences Laboratory in Missoula, MT, part of the Forest Service's Rocky Mountain Research Station.

Old-Growth Larch

By the 1990s, much of the area around Seeley Lake was "a dense tangle of shade-tolerant Douglas-fir,

Figure 1—*Campground at Seeley Lake, MT. The vault toilet in the foreground was installed to protect water quality under a stewardship contract awarded in 2001. Photo: USDA Forest Service.*

What Is Ecological Restoration?

Ecological restoration entails an array of activities to restore the structure, function, and composition of ecosystems to a semblance of their presettlement conditions. A key component is "restoration forestry" (Arno and Fiedler 2005), which promotes projects and programs to remove excess vegetation from fire-adapted ecosystems and allow fire to play more of an ecological role. The combination of restoration treatments emulates fire's historical role in shaping fire-adapted ecosystems.

Aligned Goals

Generally speaking, the USDA Forest Service's highest priority for restoration projects is in ecosystems where fire return intervals were historically shortest, where fire severities were generally lower than today, and where the alteration from historical conditions, after a century or more of fire exclusion, is therefore greatest (fire regimes I and II, condition classes 2 and 3 [Schmidt and others 2002]). In the West, that usually means the relatively dry forest types at the lower elevations where many people live and where fire hazards are therefore greatest (Williams 2004, 2005). Much of the focus has been on ponderosa pine (Friederici 2003).

There is widespread agreement that many ponderosa pine forests are overgrown, unhealthy, and hazardous to the people who live in them. Restoration treatments can be ecologically as well as socially and economically beneficial: Removing excess vegetation can reduce the fire danger to communities while restoring forests to something resembling their condition before European settlement. Then low-severity fire can be safely reintroduced in some places, both to prevent dangerous fuel buildups and to sustain forest health and productivity. Restoration and maintenance projects can foster local jobs and raise local incomes while domestically meeting more of the Nation's need for biomass and wood fiber. Everyone wins.

Difficult Tradeoffs

However, ecological restoration might not be possible where social and ecological objectives fail to align. In California's chaparral, for example, when frequent fire is introduced to control hazardous fuels, the ecosystem can weaken and collapse, clearing the way for invasive weeds (Keeley 2003). But if chaparral is left untreated, the resulting fires can be disastrous. The October 2003 fires in southern California are a case in point: Twenty-four lives were lost and 3,600 homes destroyed.

In any case, the effectiveness of fuels treatment in chaparral appears doubtful. Keeley (2005) has found "overwhelming evidence that young fuels—even fuel breaks—will not prevent fire spread in southern California's shrublands" under extreme weather conditions, such as Santa Ana winds. The most cost-effective policy might be simply to protect the wildland/urban interface. In stand replacement fire regimes such as chaparral, land managers might sometimes have to choose between protecting the wildland/urban interface and managing for ecological restoration.

subalpine fir, and Engelmann spruce" (Arno and Fiedler 2005). Most stands had been logged decades earlier, and a dense mixed-conifer forest now flourished on most sites. But one site was exceptional—the Girard Grove. Girard was part of an early-day timber sale (Sanders 2005), but its big trees were never removed. Researchers concluded that Girard "appeared to represent much of the original forest around Seeley Lake" (Arno and Fiedler 2005).

The fire regime at Girard was largely due to frequent burning by American Indians.

Like most forested sites around Seeley Lake, Girard is relatively flat and generally moist. On mountain slopes away from the lake, Arno and others (1997) found evidence of mixed-severity and stand replacement fires at relatively long intervals. At Girard, however, fires had been far more frequent: Low- to moderate-severity fires had burned through the area at average intervals of 25 years for at least several hundred years.

The fire regime at Girard, though probably influenced by lightning fires, was apparently largely due to frequent burning by American Indians (see the sidebar on page 30). The resulting open stand was

dominated by large, fire-resistant trees, particularly western larch. The site is generally too moist for ponderosa pine but suitable for larch, a shade-intolerant early-successional species in the mixed-conifer forest type at low to intermediate elevations in the Northern Rockies.

Arno and others (1997) found that larch had regenerated in every century since the 1400s. Nonlethal and mixed-severity fires had kept down competing conifers, creating an uneven-aged stand with about 20 overstory trees per acre—mostly thick-barked larch—and a basal area of about 85 square feet (20 m^2/ha). Huge ancient larches still dominate the site (fig. 2). The largest, at 7 feet (2.1 m) thick and apparently about a thousand years old, is the U.S. champion western larch.

Figure 2—*Forest Service visitors pose in front of the U.S. champion western larch in the Girard Grove, Seeley Lake Ranger District, Lolo National Forest. After thinning and underburning, the stand now approximates the open conditions under which larches such as this—about 7 feet thick and a thousand years old—could grow and flourish. Photo: USDA Forest Service, 2003.*

Seeley Lake shows the importance of questioning the "naturalness" of a given landscape.

Fire Use by American Indians

For centuries, American Indians evidently burned an open stand of old-growth western larch near Seeley Lake, MT. Perhaps it was to drive deer; perhaps to open the forest so grasses and herbs could grow, attracting deer and other game; or perhaps to clear a lakeside corridor for travel and trade or for better seasonal living, free from the danger of crown fire or ambush by hidden enemies or grizzly bears. The effect was to freeze vegetation at an early-successional stage and, by limiting the number of trees on a highly productive site, to grow them into long-lived giants.

Although nothing else would seem to explain the persistence of early-successional old-growth conditions, Arno and Fiedler (2005) are careful to present the evidence in conditional terms:

> *Evidence from fire science, archeological studies, and historical use of the area by native peoples suggests that aboriginal burning practices were largely responsible for the pattern of frequent fires at Seeley Lake (Arno, Smith, and Krebs 1997). In the 1890s, a U.S. Geological Survey forest inspector noted: "There is no doubt that some of the fires, especially on the higher ranges, are due to lightning, but most of those in the valley seem to have been set by Indians and other hunting parties or by prospectors. The trails most frequented by Indians, as the Jocko and Pend Oreille, are noticeably burned, especially about the camping places" (Ayres 1901, p. 72). According to Lolo National Forest archeologist Milo McLeod, numerous artifacts suggest a sustained level of aboriginal activity (camping) in the vicinity of Girard Grove extending back 3,500 years.*

The forest was converting from early-successional old growth sustained by frequent fires to a late-successional stage susceptible to a stand replacement fire.

Forest in Decline

But the old-growth forest was in decline (Arno and others 1997; Arno and Fiedler 2005). During the longest fire-free interval before 1900 (42 years), Douglas-firs had sprung up, and some had survived the last two fires, in 1844 and 1859, respectively. By 1995, after more than 130 years without a fire, Girard's basal area had more than doubled to 226 square feet per acre (52 m^2/ha), and the number of trees had more than quadrupled. An additional 250 Douglas-firs per acre now formed a "patchy understory layer" (Arno and others 1997). Subalpine fir and Engelmann spruce were increasing in the understory, and the original pinegrass undergrowth had given way to shade-tolerant plants such as kinnikinnick.

In effect, the forest was converting from an old-growth early-successional stage sustained by nonlethal and mixed-severity fires to a late-successional stage highly vulnerable to a stand replacement fire. Stagnating lodgepole pines and larger Douglas-firs were succumbing to bark beetle infestations, and an understory of small Douglas-firs was developing. These crowded conditions prevented larch regeneration; the youngest larch was now 130 years old (Arno and others 1997).

Such ecological responses to a history of fire exclusion threatened to destroy the grove's unique old-growth treasures. Although the old larches still appeared relatively healthy, competition from younger, more vigorous Douglas-firs would eventually weaken them and make them prone to disease and insect attack. Moreover, understory conifers and other ladder fuels threatened to carry any fire into the canopy during a late-summer drought. Conditions in the stand were increasingly unsustainable.

Restoration Treatments

The land and resource management plan for the Lolo National Forest, adopted in 1986, recognized the importance of managing ecosystems for the historical processes that shaped them. Based on results from research at Girard, the managers of the Seeley Lake Ranger District decided to restore conditions resembling those in the original forests around Seeley Lake. Characteristically, the district's restoration goals aligned social, economic, and ecological objectives, including:

- Protecting remaining old-growth trees;
- Improving wildlife habitat for species such as elk (winter range) and northern goshawk (open forest for foraging);
- Reducing the crown fire danger to local residents and seasonal visitors; and
- Furnishing local jobs and income.

Working with the local Pyramid Mountain Lumber Company and other partners, the district launched a series of restoration projects in areas once dominated by relatively open larch forests (fig. 3). Treatments were generally along

Figure 3—*Restoration forestry in a stand of old-growth western larch on the Seeley Lake Ranger District. Before treatment, dense ladder fuels threatened to carry a fire into the canopy (upper left). To protect soils, a contractor worked on a winter snowpack to remove and chip some of the trees (upper right). In spring, when conditions were right, the stand was underburned (lower left). The result approximates historically open forest conditions (lower right). Photos: USDA Forest Service.*

the "chain-of-lakes" recreation corridor, particularly near campgrounds around Seeley Lake, including the Girard Grove. Areas treated have ranged from an initial 100 acres (40 ha) in 1995 to 1,300 acres (520 ha) in 2003.

Treatments were generally designed to restore stand structures to something resembling presettlement conditions by removing small and medium-size trees, particularly Douglas-firs and lodgepole pines (see the sidebar). After basal area was reduced by up to half, small prescribed fires were reintroduced in some stands (Arno and Fiedler 2005).

Clearwater Project

Despite fears to the contrary, the treatments proved commercially viable. Encouraged, the Seeley Lake Ranger District bundled a restoration treatment with other work under a relatively new Forest Service authority called stewardship contracting. Until 2003, the new authority was still being pilot tested, and district managers launched the Clearwater Project as part of the test.

Under a stewardship contract, the Forest Service outlines broad outcomes on the land, and the contractor is responsible for achieving them on the ground. Although the tasks needed to fulfill the contract might not be directly related, they are usually designed to foster landscape-scale ecological restoration and outdoor recreation. At Seeley Lake, for example, tasks ranged from campground improvements (to benefit recreational visitors), to vegetation removal (to repair forest structure), to bridge installation (to restore upstream spawning habitat for trout) (fig. 4).

The Archibald Timber Sale*

The first restoration forestry project at Seeley Lake, MT, came in 1995 through a timber sale on 100 acres (40 ha) near a campground. The goal was twofold: to keep younger, more vigorous trees from outcompeting old western larches and from carrying fire into the canopy; and to begin restoring an open stand structure representative of historical conditions.

To protect forest soils, the contractor worked on a 2-foot (0.6-m) snowpack in winter. On a representative 1-acre (0.4-ha) plot, all but 12 trees with a diameter at breast height (dbh) of 14 inches (36 cm) or less were removed, including:

- 165 Douglas-firs,
- 91 lodgepole pines, and
- 9 western larches.

Every tree with a dbh greater than 14 inches (36 cm) was retained, including:

- 26 western larches,
- 3 Douglas-firs, and
- 1 ponderosa pine.

The largest remaining trees were six western larches with a dbh of 32 to 48 inches (82–122 cm). Basal area declined from 194 square feet per acre (45 m^2/ha) to 128 square feet per acre (29 m2/ha). Figure 3 gives an idea of the results.

* Based on Arno and Fiedler (2005), especially table 11.1.

District managers decided to restore conditions resembling those in the original forests around Seeley Lake.

Where necessary, a stewardship contract can be supported by appropriated funds, but if the work includes removing merchantable vegetation, then the contractor offsets at least part of the costs by selling or milling the material removed. The goods-for-services approach helps short-funded public land managers leverage scarce resources: Instead of being returned to the Federal treasury, timber proceeds go toward supporting other local work.

Figure 4—*Large-span bridge installed to replace a degraded culvert as part of the Clearwater Project on the Seeley Lake Ranger District. For the first time in many years, spawning bull trout could pass upstream from the bridge. Photo: USDA Forest Service.*

At Seeley Lake, the tasks bundled under the Clearwater Project included:

- Thinning lodgepole pine on 640 acres (256 ha), followed by prescribed burning;
- Obliterating 12.8 miles (21.6 km) of old, unneeded forest road and

Through a stewardship contract, timber proceeds stayed on the ground to support ecological restoration and outdoor recreation.

blocking access to 38 miles (61 km) of old logging roads to improve grizzly habitat;
- Reconditioning or reconstructing 15 miles (24 km) of road;
- Graveling about 1 mile (1.6 km) of road and rerouting a section to improve stream habitat;
- Treating noxious weeds along 12.6 miles (20.3 km) of road;
- Installing 7 bridges and arch pipes to restore upstream spawning habitat for endangered bull trout;
- Rehabilitating a gravel pit;
- Installing 18 sweet-smelling vault toilets at local campgrounds to protect water quality (fig. 1); and
- Reconstructing a trailhead and a recreation facility.

In 2001, the local Pyramid Mountain Lumber Company won the contract in a competitive bidding process. Part of the work was in overcrowded stands of lodgepole pine, where Pyramid worked to restore the variable stocking levels historically maintained by mixed-severity fires (fig. 5). The main goal was to protect the stands from attack by mountain pine beetle, but an important benefit was to reduce the danger of crown fire. To protect forest soils, Pyramid worked on a winter snowpack to remove some of the trees. In spring, when conditions were right, Pyramid applied fire to improve wildlife habitat.

Figure 5—*Result of a thinning-and-burning treatment in lodgepole pine, part of the Clearwater Project, to restore the variable stocking levels historically maintained by mixed-severity fires. Photo: USDA Forest Service.*

For the rest of the work, Pyramid subcontracted with 10 different local contractors, thereby furnishing local jobs and keeping most timber proceeds in the local community. Pyramid was able to fulfill its contract within 2 years while still making a profit. Most of the work would have taken far longer to accomplish through appropriated funds, according to District Ranger Tim Love.

The tiny Montana community of Seeley Lake offers an example of people working together to align ecological goals with social and economic expectations.

Monitoring outcomes was key. Chaired by a forestry professor from the University of Montana, a multiparty monitoring committee reviewed work under the stewardship contract (fig. 6). The committee included representatives from the National Forest Foundation, Trout Unlimited, the National Wildlife Federation, the timber industry, the local water board, and the Seeley Lake Ranger District. The committee issued a report cataloguing outcomes and outlining lessons learned. The Pinchot Institute, a nongovernmental organization based in Washington, DC, collected the data from this and other stewardship contracts and reported to Congress. In 2003, based on generally positive results, Congress gave Federal land managers broad authority to continue and expand stewardship contracting nationwide.

Figure 6—*Before the dramatic backdrop of the Swan Range, members of the monitoring committee for the Clearwater Project visit a site where part of the work is taking place, including treatments in an overcrowded stand of lodgepole pine (treetops are visible in the background) and rehabilitation of a gravel pit (below the rise in the foreground). Photo: USDA Forest Service.*

The Clearwater Project was a resounding success, demonstrating the effectiveness of bundling restoration treatments across the landscape. Perhaps best of all, it gave Pyramid and others in the community a clear sense of "ownership" for the outcomes. At the same time, it improved the image of forest workers and the Forest Service in the eyes of an often skeptical public.

Seeing Is Believing

Not everyone in the community was initially enthusiastic about Clearwater and the other restoration projects. In the early 1990s, the Forest Service had encountered

stiff public resistance to timber removal along the locally prized "chain-of-lakes" recreation corridor. Some people had also complained about the danger of prescribed fire and the associated smoke nuisance (Arno and Fiedler 2005).

But public opposition softened as more and more wildfires threatened homes in the region and as people began seeing positive results from restoration treatments. Especially impressive were the huge orange-barked larches and, on warmer upland sites, old-growth ponderosa pines—treasures previously hidden by dense walls of smaller conifers. Seeing restoration forestry in practice prompted some local landowners to begin similar treatments around their own homes and summer cabins.

Similarly successful restoration projects have also found increasing public support in the adjacent Swan Valley, such as through the Flathead Forestry Project in Condon, MT (Schwenneson 2001). Arno and Fiedler (2005) as well as Friederici (2003) describe a number of restoration projects elsewhere in the West.

Growing public acceptance, believes District Ranger Love, will foster even more comprehensive projects for larch regeneration and other restoration projects near Seeley Lake. Ultimately, his goal is to restore historical forest conditions throughout the area, especially the larch stands so valuable for wildlife and so cherished by local residents and visitors alike. In that, he follows in the footsteps of the ancient forest's first inhabitants—and progenitors—eons ago.

The Seeley Lake Model

Seeley Lake shows the importance of grasping the ecological processes that historically governed a site. The vegetation growing in a particular location, even if seemingly healthy, can deceive if the historical processes that shaped the ecosystem have been disrupted. Before considering treatments, managers should acquire a good understanding of historical conditions, if necessary with help from researchers.

Especially impressive were the huge orange-barked larches—treasures previously hidden by dense walls of smaller conifers.

Ecological restoration—especially restoration forestry—is also predicated on aligning a community's social, economic, and ecological goals. Historical conditions at Seeley Lake generally supported efforts to restore relatively open stands maintained by nonlethal or mixed-severity fires, and the community apparently benefited as a result. In historically more dense forest types within the stand replacement fire regime, restoration forestry might be less feasible. However, Arno and Fiedler (2005) document successful restoration projects in a wide array of forest types, including some—such as lodgepole pine—in the stand replacement fire regime.

For more on ecological restoration near Seeley Lake, contact Tim Love, USDA Forest Service, Seeley Lake Ranger District, Seeley Lake, MT 59868, 406-677-2233 (voice), tlove@fs.fed.us.

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Two Golden Smokey Awards Presented for 2004

Lewis F. Southard

The national Cooperative Forest Fire Prevention (CFFP) program presented two Golden Smokey Awards in 2004 to honor sustained, outstanding contributions to wildland fire prevention. The Golden Smokey Award is given for significant contributions to wildland fire prevention programs going beyond normal job requirements over a period of at least 2 years. A maximum of three Golden Smokey Awards may be given annually.

Golden Smokey Award winners Bill Sweet (second from left) and Paul Metcalf (third from left) pose with Dale Bosworth (left), Chief of the USDA Forest Service, and Burnell C. Fischer, President of the National Association of State Foresters: Photo: USDA Forest Service, 2004.

The 2004 awards came as a surprise to both recipients. They were presented on September 27, 2004, at the annual meeting of the National Association of State Foresters (NASF) in Jackson, MS. Joel Frandsen, CFFP chair, introduced the two award winners. Burnell C. Fischer, NASF President and State Forester of Indiana, and Dale N. Bosworth, USDA Forest Service Chief, then presented each award winner with a golden Smokey Bear statuette.

Paul Metcalf

One award went to Paul S. Metcalf, a recently retired fire prevention officer for the Forest Service whose last assignment was on the Groveland Ranger District, Stanislaus National Forest, CA. Paul had long recognized problems with wildland fire prevention signage in California, where he worked. Many signs appeared amateurish and carried wording that was too small and difficult to read from a moving vehicle. Some led to misinterpretation, especially among visitors whose first language was not English.

In 1991, Paul began working to change all that. He led an effort endorsed by the Northern California Interagency Wildland Fire Prevention Committee, devoting his personal time to creating

"Smokey's Fan Mail," by the renowned Smokey artist Rudy Wendelin, was the model for a life-size Smokey display in the visitor center at the USDA Forest Service's national office in Washington, DC. Photo: USDA Forest Service.

Lew Southard is the branch chief for fire prevention for the USDA Forest Service, Fire and Aviation Management Staff, Washington Office, Washington, DC.

The Golden Smokey Award recognizes significant contributions to wildland fire prevention programs going beyond normal job requirements.

109 different posters with 20 different messages in English and Spanish, all in sizes suitable for a variety of standard sign mounts and road conditions. Today, the posters are available for Forest Service use nationwide. They are contained in the agency manual *Standards for Forest Service Signs and Posters* (EM 7100–15).

Bill Sweet

The second award was presented to Bill Sweet, a program manager for the Forest Service's Southern Region in Atlanta, GA, and a familiar figure in wildland fire prevention education. Through his efforts, a consolidated wildland fire prevention education program has spread nationwide, and more information is now available than ever before to those who work in wildland fire prevention.

Bill has personally initiated and supported National Fire Prevention and Education Teams all over the country, volunteering many hours of his time to make sure the training occurred. He also obtained and preserved artwork from the renowned Rudy Wendelin, perhaps Smokey's most famous artist. Thanks to Bill's efforts, historical images of Smokey Bear are now archived and available for anyone to see. Bill also donated many hours to developing the discovery center at the Forest Service's Washington Office in Washington, DC, where visitors can view Smokey in his office—a life-size recreation of Wendelin's famous rendition of Smokey reading fan mail.

Nominations

Nominations for Smokey Bear Awards are due each year in the spring. Anyone wishing to submit a nomination should complete a nomination form and attach supporting materials such as news clippings and photographs. All award materials are available at <http://www.symbols.gov/sbaw.html>. Each nominee must meet three minimum selection criteria:

- At least 2 years of activities must be complete and not in the planning or development stage;
- Activities must demonstrate success in the geographical area for which nominated (nationwide for the Golden Smokey, regionwide for the Silver Smokey, and statewide for the Bronze Smokey); and
- Service must be beyond the normal scope of the nominee's job.

Nominees who meet the minimum selection criteria are evaluated based on additional factors (see the sidebar). The completed forms and supporting documentation should be submitted to regional CFFP coordinators. For more information, contact Lou Southard, USDA Forest Service, Fire and Aviation Management, Mail Stop 1107, 1400 Independence Avenue, SW, Washington, DC 20250-1107, 202-205-0891 (voice), 202-205-1272 (fax), lsouthard@fs.fed.us (e-mail). ■

What Factors Help Determine Smokey Award Decisions?

Representatives from the National Association of State Foresters, the USDA Forest Service, and The Advertising Council jointly select Smokey Award winners from a pool of candidates who meet the minimum selection criteria (at least 2 years of completed, successful activities beyond the scope of the nominee's job). What follows is a partial list of factors considered by evaluators in selecting award winners from the pool of eligible candidates.

- Is there a specific project that made a tangible contribution to wildland fire prevention?
- Is the nominee a volunteer or did the project use volunteers?
- Was the project interagency?
- Was the project creative, innovative, and community based or supported?
- Was the project self-initiated?
- Was the project a model of success and replicated elsewhere?
- Did the project incorporate multicultural concerns?
- Did the project have a multiplier effect?
- Has the work received agency or community recognition?
- Was the media involved in the project?
- Did the project involve more than one contact with the targeted audience?
- Is the nominee an inspiration to others, a catalyst for other activity?
- Does the nominee exhibit leadership among peers?

Fire Management Today Announces 2004 Photo Contest Winners

Madelyn Dillon

Surpassing our expectations and any previous year's entries, *Fire Management Today* received more than 560 images from about 86 people for our 2004 photo contest. Thanks to everyone who contributed their best fire-related images in the 2004 competition.

We asked people to submit images in six categories:

- Wildland fire,
- Prescribed fire,
- Wildland/urban interface,
- Aerial resources,
- Ground resources, and
- Miscellaneous (fire effects, fire weather, fire-dependent communities or species, etc.).

After the contest deadline (the first Friday in March), we evaluated the submissions and eliminated all technically flawed images, such as those with soft focus or low resolution. Despite technical flaws, many of these images were otherwise outstanding.

Next, three fire safety experts reviewed the images to ensure that they did not show unsafe firefighting practices (unless that was their purpose). If an unsafe practice was evident, we disqualified the image from competition.

Finally, three judges reviewed, scored, and ranked the remaining images based on traditional photography criteria.

Do you have an image that tells a story about wildland firefighting? Would you like to see your photo in print? Turn to the inside back cover for information about our next photo contest. ■

Madelyn Dillon is the editor of Fire Management Today, *Fort Collins, CO.*

FMT Photo Experts

We assembled an excellent panel of judges, people with years of photography experience, and we made sure that fire safety experts evaluated the photos. Our appreciation goes to these six folks for their willingness to share their time and knowledge. The panel included:

Judges

- Lane Eskew is an editor with the Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Evaluating photographs submitted by authors for publication is an integral part of Lane's job. Outdoor magazines, books, brochures, and other media have published Lane's photographs over the past 14 years.
- Barbara Menzel is a computer programmer for the Forest Service, Forest Management Service Center, Fort Collins, CO. She has been an amateur photographer for almost 16 years. The 2004 Cheyenne Frontier Days Quicksilver Photography Show in Cheyenne, WY, recently displayed a collection of her photographs.
- Jim Saveland, an assistant director for research at the Forest Service, Rocky Mountain Research Station, Fort Collins, CO, has been with the agency for more than 25 years. The first half of Jim's career was in fire management, including assignments on a district fire crew and as a smokejumper. The second half of Jim's career has been in Research and Development, where he was a project leader at the Macon fire laboratory and the national program leader for fire systems research in the Washington Office before accepting his current position.

Safety Experts

- Mike Apicello, a public affairs officer with the National Interagency Fire Center, Boise, ID, has been with the USDA Forest Service for more than 28 years. Most of Mike's career has been in fire, forestry, and public affairs. His professional experience includes crew foreman and boss, smokejumper, type 1 information officer, national safety officer, and national public affairs officer.
- Tammy Denney, a webmaster for Forest Service, Fire and Aviation Management, Washington, DC, has been with the agency for more than 17 years. As webmaster, Tammy develops and designs specialized fire-related communication materials for a broad audience. Her diversified experience includes national contracting, budget and fiscal management, public affairs, wildland fire safety, and fuels program analysis.
- Stan Underwood, a program manager with the Forest Service, Content Analysis Service Center, Salt Lake City, UT, has been with the agency for 33 years. Stan's fire-related assignments have included work as a smokejumper and as a program manager in silviculture and fire, in addition to numerous suppression assignments in various red-carded positions, including safety and incident commander type 3. He has also served as an operations section chief on a type 2 incident management team since 1989.

First Place, Wildland Fire. *Intense fire heat consumed the fine fuels and became ghost ash during the Kinishba Fire in Arizona. Photo: Kari Greer, National Interagency Fire Center, Boise, ID, 2003.*

Second Place, Wildland Fire. *Extreme fire behavior on the Blackhall Fire in Wyoming. Photo: Kari Greer, National Interagency Fire Center, Boise, ID, 2000.*

Third Place, Wildland Fire. *What's left behind? A charred tree silhouetted against a cloud of smoke on the Bull Dog Fire in Utah's Henry Mountains. Photo: Becky Blankenship, USDA Forest Service, Logan Ranger District, Wellsville, UT, 2003.*

First Place, Prescribed Fire. *A firefighter feels the heat during an ignitions class at the Great Plains Wildfire College in Sterling, CO. Photo: Eric Peter Abramson, USDA Forest Service, Arapaho Roosevelt National Forest, Fort Collins, CO, 2004.*

Second Place, Prescribed Fire. *Firefighters finish a prescribed burn after a long day at Custer State Park, Black Hills National Forest, SD. Photo: Randall Benson, South Dakota School of Mines, Rapid City, SD, 2003.*

Third Place, Prescribed Fire. *Ignition of oldfield/pitch pine unit during a spring prescribed burn at Camp Edwards in Sandwich, MA. Photo: Joel Carlson, The Nature Conservancy, Plymouth, MA, 2004.*

First Place, Wildland/Urban Interface. *Tribal members watch the Encebado Fire on Taos Pueblo land in New Mexico. Photo: Ignacio Peralta, Carson National Forest, Taos, NM, 2003.*

Second Place, Wildland/Urban Interface. *Firefighters in the wildland/urban interface pause to watch a retardant drop on the Burn Canyon Fire in Colorado. Photo: Kari Greer, National Interagency Fire Center, Boise, ID, 2002.*

Third Place, Wildland/Urban Interface. *Smoke plumes on the horizon north of Sioux Lookout on the Lac Seul Fire in Ontario, Canada. Fire suppression and backburn efforts made an evacuation of the town unnecessary. Photo: Ministry of Natural Resources, Fire Management Centre, Dryden, ON, 2003.*

First Place, Aerial Resources. *An Erickson Air Crane dips into a pond to fill its tank on the Oakhead Complex Fire, Osceola National Forest, FL. Photo: Kari Greer, National Interagency Fire Center, Boise, ID, 1998.*

Second Place, Aerial Resources. *The Silver City tanker base at the end of a long day during the Middle Fire on the Gila National Forest, NM. Shown are a Forest Service BE–58 Baron, a P–3 tanker, a DC–4 tanker, and—silhouetted against the sun—a PB4Y–2, tanker 123. Photo: Thomas French, USDA Forest Service, Southwestern Region, Albuquerque, NM, 2002.*

Third Place, Aerial Resources. *Helitorch used on the Mad Creek Fire, Medicine Bow/Routt National Forest, CO. Photo: Kari Greer, National Interagency Fire Center, Boise, ID, 2001.*

Honorable Mention, Aerial Resources. *Crane-style helicopter taking on water at Sugar Pine Reservoir to fight the Cod Fire, El Dorado National Forest, near Foresthill, CA. Photo: Wes Schultz, California Department of Forestry and Fire Protection, Rocklin, CA, 2003.*

Honorable Mention, Aerial Resources. *Ontario's CL–415 heavy-water bomber drops its load of water on the Sioux Lookout District Fire Number 17 in northwestern Ontario early in the fire season. The suspected cause of the fire was a cigarette thrown from a vehicle that ignited grass along the highway roadside. Photo: Tom Nebbs, Sioux Lookout, Ontario, Canada, 2003.*

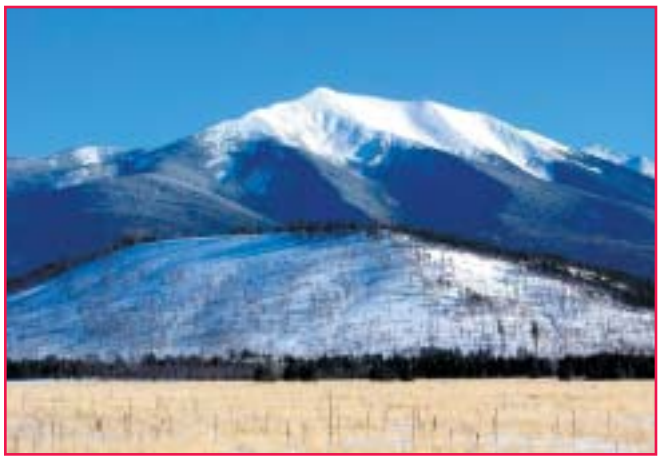
First Place, Ground Resources. *Keeping an eye on fire activity at sunset on the Bureau of Land Management's Ely District in Nevada. Photo: Eli Lehmann, USDA Forest Service, Mount Baker–Snoqualmie National Forest, Willard, WA, 2002.*

Second Place, Ground Resources. *Firefighters watch smoldering trees 23 miles (37 km) south of Jackson, WY, on the Bridger–Teton National Forest. An estimated 750 acres (300 ha) were burning, and firefighters were evaluating possible suppression tactics. Photo: Jed Conklin, The Spokesman Review, Spokane, WA, 2003.*

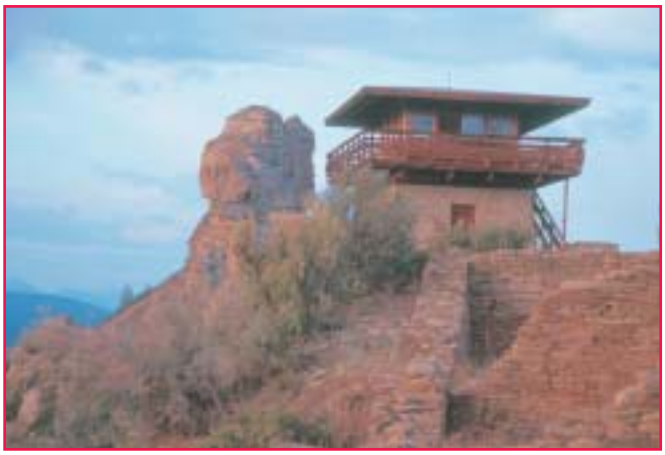
Third Place, Ground Resources. *Firefighter lights a backfire on the Togo Fire, Colville National Forest, Colville, WA. Photo: Eli Lehmann, Mount Baker Snoqualmie National Forest, Willard, WA, 2003.*

Miscellaneous

First Place, Miscellaneous. *Logan Hotshots and Navajo Hotshots work to evacuate an injured firefighter on the B&B Complex Fire, Deschutes National Forest, OR. It took half the day to carry him across the lava flow. Photo: Becky Blankenship, USDA Forest Service, Logan Ranger District, Wellsville, UT, 2003.*



Second Place, Miscellaneous. *Eight years after the 1996 Hockderffer Fire on the Coconino National Forest near Flagstaff, AZ, the forest slowly recovers. In the background are the majestic San Francisco Peaks. Photo: Bob Blasi, USDA Forest Service, Coconino National Forest, Flagstaff, AZ, 2004.*



Third Place, Miscellaneous. *Chimney Rock Lookout, Pagosa Ranger District, San Juan National Forest, Durango, CO. Used until the late 1960s, the cabin was rebuilt in the 1990s. Great House Pueblo ruins are in the foreground and Companion Rock is in the background. Photo: Mark Roper, San Juan National Forest, Durango, CO, 2003.*

Honorable Mention, Miscellaneous. *While gridding on the Flagtail–Malheur Complex Fire in Oregon, a firefighter found an unattended fawn. The doe returned for the fawn later that afternoon. Photo: Willie Cirone, New Jersey Forest Fire Services, Budd Lake, NJ, 2002.*

GUIDELINES FOR CONTRIBUTORS

Editorial Policy
Fire Management Today (*FMT*) is an international quarterly magazine for the wildland fire community. *FMT* welcomes unsolicited manuscripts from readers on any subject related to fire management. Because space is a consideration, long manuscripts might be abridged by the editor, subject to approval by the author; *FMT* does print short pieces of interest to readers.

Submission Guidelines
Your manuscript may be hand-written, typed, or word-processed, and you may submit it either by e-mail or mail. If you submit your manuscript by e-mail, send it to either the general manager or the managing editor at one of the following addresses. If you submit your manuscript by regular mail or courier service, send it to Managing Editor Hutch Brown.

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Author Information. Include the complete name(s), title(s), affiliation(s), and address(es) of the author(s), as well as telephone and fax numbers and e-mail information. If the same or a similar manuscript is being submitted elsewhere, include that information also.

Logo. Authors who are affiliated should submit a camera-ready logo for their agency, institution, or organization.

Electronic files. If you are mailing a word-processed manuscript, submit it on a 3-1/2 inch, IBM-compatible disk. Please label all disks carefully with name(s) of file(s) and system(s) used. Submit electronic text files, whether by e-mail or on a disk, in one of these formats: WordPerfect 5.1 for DOS; WordPerfect 7.0 or earlier for Windows 95; Microsoft Word 6.0 or earlier for Windows 95; Rich Text format; or ASCII.

Do not embed illustrations (such as photos, maps, charts, and graphs) in the electronic file for the manuscript. We will accept digital images if the image was shot at the highest resolution using a camera with at least 2.5 megapixels or if the image was scanned at 300 lines per inch or equivalent. Submit each illustration in a standard interchange format such as EPS, TIFF, or JPEG, accompanied by a high-resolution (preferably laser) printout. For charts and graphs, include the raw data needed to reconstruct them.

Style. Authors are responsible for using wildland fire terminology that conforms to the latest standards set by the National Wildfire Coordinating Group under the National Interagency Incident Management System. *FMT* uses the spelling, capitalization, hyphenation, and other styles recommended in the *United States Government Printing Office Style Manual*, as required by the U.S. Department of Agriculture. Authors should use the U.S. system of weight and measure, with equivalent values in the metric system.

Try to keep titles concise and descriptive; subheadings and bulleted material are useful and help readability. As a general rule of clear writing, use the active voice (e.g., write, "Fire managers know…" and not, "It is known…"). Provide spellouts for all abbreviations. Consult recent issues (at <http://www.fs.fed.us/fire/fmt/index.html>) for placement of the author's name, title, agency affiliation, and location, as well as for style of paragraph headings and references.

Tables. Tables should be logical and understandable without reading the text. Include tables at the end of the manuscript.

Photos and Illustrations. Clearly label all photos and illustrations (figure 1, 2, 3, etc.; photograph A, B, C, etc.). At the end of the manuscript, include clear, thorough figure and photo captions labeled in the same way as the corresponding material (figure 1, 2, 3; photograph A, B, C; etc.). Captions should make photos and illustrations understandable without reading the text. For photos, indicate the name and affiliation of the photographer and the year the photo was taken.

Release Authorization. Non-Federal Government authors must sign a release to allow their work to be in the public domain and on the World Wide Web. In addition, all photos and illustrations require a written release by the photographer or illustrator. The author, photo, and illustration release forms are available from General Manager Melissa Frey.

Contributors Wanted

We need your fire-related articles and photographs for *Fire Management Today*! Feature articles should be up to about 2,000 words in length. We also need short items of up to 200 words. Subjects of articles published in *Fire Management Today* include:

- Aviation
- Communication
- Cooperation
- Ecosystem management
- Equipment/Technology
- Fire behavior
- Fire ecology
- Fire effects
- Fire history
- Fire science
- Fire use (including prescribed fire)
- Fuels management
- Firefighting experiences
- Incident management
- Information management (including systems)
- Personnel
- Planning (including budgeting)
- Preparedness
- Prevention/Education
- Safety
- Suppression
- Training
- Weather
- Wildland–urban interface

To help prepare your submission, see "Guidelines for Contributors" in this issue.

Photo Contest Announcement

Fire Management Today (FMT) invites you to submit your best fire-related photos to be judged in our annual competition. Judging begins after the first Friday in March of each year.

Awards

All contestants will receive a CD with the images remaining after technical review. The CD will identify the winners by category. Winning photos will appear in a future issue of *FMT*. In addition, winners in each category will receive:

- 1st place—Camera equipment worth $300 and a 16- by 20-inch framed copy of your photo.
- 2nd place—An 11- by 14-inch framed copy of your photo.
- 3rd place—An 8- by 10-inch framed copy of your photo.

Categories

- Wildland fire
- Prescribed fire
- Wildland/urban interface fire
- Aerial resources
- Ground resources
- Miscellaneous (fire effects; fire weather; fire-dependent communities or species; etc.)

Rules

- The contest is open to everyone. You may submit an unlimited number of entries taken at any time. No photos judged in previous *FMT* contests may be entered.
- You must have the right to grant the Forest Service unlimited use of the image, and you must agree that the image will become public domain. Moreover, the image must not have been previously published.
- We prefer original slides or negatives; however, we will accept duplicate slides or high-quality prints (for example, those with good focus, contrast level, and depth of field). ***Note:*** We will not return your slides, negatives, or prints.
- We will also accept digital images if the image was shot at the highest resolution using a camera with at least 2.5 megapixels or if the image was scanned at 300 lines per inch or equivalent with a minimum output size of 5 x 7. Digital image files should be TIFFs or highest quality JPGs.
- You must indicate only one competition category per image. To ensure fair evaluation, we reserve the right to change the competition category for your image.
- You must provide a detailed caption for each image. For example: *A Sikorsky S–64 Skycrane delivers retardant on the 1996 Clark Peak Fire, Coronado National Forest, AZ. Photo: name, professional affiliation, town, state, year image captured.*
- A panel of experienced judges determines the winners. Its decision is final.
- We will eliminate photos from competition if they are obtained by illegal or unauthorized access to restricted areas; lack detailed captions; have date stamps; show unsafe firefighting practices (unless that is their express purpose); or are of low technical quality (for example, have soft focus or show camera movement).
- You must complete and sign the release statement granting the USDA Forest Service rights to use your image(s). Mail your completed release with your entry or fax it (970-295-5815) at the same time you e-mail digital images.

Mail entries to:

USDA Forest Service
Fire Management Today Photo Contest
Madelyn Dillon
2150 Centre Avenue
Building E, Suite 008
Fort Collins, CO 80526
or
e-mail images and captions to:
<mdillon@fs.fed.us> and
fax signed release form to
970-295-6799 (attn: Madelyn Dillon)

Postmark Deadline

First Friday in March

Sample Photo Release Statement

Enclosed is/are _____ (number) image(s) for publication by the USDA Forest Service. For each image submitted, the contest category is indicated and a detailed caption is enclosed. I have the authority to give permission to the Forest Service to publish the enclosed image(s) and am aware that, if used, it/they will be in the public domain and appear on the World Wide Web.

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