Fire Management today

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Firefighting Equipment

United States Department of Agriculture
Forest Service

Coming Next...

The next issue of *Fire Management Today* (68[2] Winter 2008) will feature articles about managing the unexpected and building a highly reliable organization. Excerpt: "A highly reliable organization is really the glue or foundation for how we operate, and should strive to operate, in wildland fire management. It is a way to think logically about how to proactively develop special skills to avoid—or be better prepared for—unexpected events. It is a way to make sense of the unexpected when it does happen—and quickly recover vital systems." –Paula Nasiatka, Center Manager of the Wildland Fire Lessons Center, Tucson, AZ.

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Ed Schafer, Secretary
U.S. Department of Agriculture

Abigail R. Kimbell, Chief
Forest Service

Tom Harbour, Director
Fire and Aviation Management

Melissa Frey
General Manager

Cindy White
Managing Editor

Madelyn Dillon
Editor

Paul Keller
Editor

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On the Cover:

On the Cover: *ATV-mounted Powertorch used during a prescribed burn, Cimarron National Grasslands in Kansas, spring 2005. Photo: Brandyn Harvey, Pike Interagency Hotshot Crew.*

Equipment Definition:

Anything kept, furnished, or provided for a specific purpose.

The development of firefighting equipment has led to increased safety and efficiency for our firefighters. We've come a long way from the "Bucket Brigades" that began our history of fighting fires in the United States…

Melissa Frey, Issue Coordinator

The USDA Forest Service's Fire and Aviation Management Staff has adopted a logo reflecting three central principles of wildland fire management:

- *Innovation:* We will respect and value thinking minds, voices, and thoughts of those that challenge the status quo while focusing on the greater good.
- *Execution:* We will do what we say we will do. Achieving program objectives, improving diversity, and accomplishing targets are essential to our credibility.
- *Discipline:* What we do, we will do well. Fiscal, managerial, and operational discipline are at the core of our ability to fulfill our mission.

Firefighter and public safety is our first priority.

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Anchor Point

by Tom Harbor
Director, Fire and Aviation Management
USDA Forest Service

Better Understanding Our Strengths

On every trip I take, I am reminded of the talent present in our Fire and Aviation Management workforce. From my staff in DC to the firefighters I meet in the field, I see us growing even stronger through understanding our present and envisioning our future.

There is a widespread dedication to service, an ambition to become better problemsolvers and decision-makers—better leaders in fact. We strive to understand the big picture of resource needs such as fire regimes, with the intimate knowledge of how to safely work with a drip torch. We can think both strategically and tactically, and that is so much more than just wielding a shovel.

We can think both strategically and tactically, and that is so much more than just wielding a shovel.

True Reflection

There is documentation in the psychological field that indicates that only elephants, dolphins, chimpanzees, and humans recognize themselves in the mirror. In tests, they demonstrate that they understand what they see is themselves and not a foreign object.

A mature look into our mirror allows us to assess honestly who we are and, for most of us, drives an urge to build on our strengths and grow in our sense of professionalism and service. The obsolete image that anybody can be a wildland firefighter is gone. We know that experience and training set us apart from "*anybody*."

We know that experience and training set us apart from "*anybody*."

Growing Confidence

Our workforce, both management and first responders, have the opportunity to continue to enhance that mirror image by thoughtfully planning and implementing today's decisions so that benefits are visible in the future. Moving to a cohesive, thinking, and flexible organization is not easy, but the results personally and on the landscape will be rewarding. That's basically what the Fire Suppression Doctrine is about. With experience, leadership and decision training, and the doctrinal principles, we grow confident and strengthened for all the dynamic environments we will face.

Taking Stock

I call on the idea of a mirror as a starting point in understanding and defining who we are as skilled men and women in fire management, and how those around us reflect our attitudes. What does your reflection tell you about your current abilities and where you want to be? Take stock of where you are and where you want to be and go after those opportunities to reveal the professional you are. We'll be better individually and organizationally. ■

For further information, visit:

<http://www.fireleadership.gov>

<http://www.wildfirelesson.net/HRO.aspx>

Introducing *Fire Management Today's* New Managing Editor

Dear Readers,

My name is Cindy White, and it is a privilege to introduce myself as the new managing editor of *Fire Management Today*.

I started with the Forest Service in 1980. My education and background are in technical and scientific writing and editing, project management, environmental policy, desktop publishing, and public affairs. In addition to my 9-to-5 job, I have cultivated a 20 year-long wildland fire career along the way.

While not editing *Fire Management Today* or writing environmental documents, I like to spend my time mountain biking, backcountry skiing, gardening, and treasure hunting at garage sales with my daughter. My husband and I also enjoy cooking together for our friends and family.

I grew up in the Forest Service fire world. My dad worked most of his career as a fire management officer. He was passionate about fire, and as far back as I can remember there was a Forest Service map prominently displayed in our home, with a base radio squawking in the background.

He enjoyed teaching me as a young girl to plot fire starts on that map, as his fire crew would call in coordinates. As I grew older, I would listen to the radio while he went about "chasing smokes" in his truck. There was always a big yellow radio bag, a belt weather kit, and C-rations in the truck with dad wherever he went. I grew up thinking those were perfectly normal accessories.

As a carrier of the family fire gene—and with a wandering foot, I have instinctively followed a winding path through the incident command system. I have had many rewarding incident assignments, traveling across the United States as an information officer, communications manager, and dispatcher. My son seems to be following a similar path as part of an initial attack crew—third generation.

I confess my role in the fire organization has been the highlight of my career. I enjoy the camaraderie, the travel, and the dependable structure of the incident command system. At the same time, I am always on the lookout for the adventure of the *unknown*—that part where you never know for sure exactly where you are going to end up, or how or when you are going to get there. If you've been in the fire business for a long time, you know exactly what I mean.

I'm very excited to serve in my new role as the managing editor of *Fire Management Today*. It's a great new adventure, and I look forward to continuing to provide you with the high-quality, informative, and interesting journal that *Fire Management Today* has become. ■

Calling All Rangers!

A Brief History of Radio in the Forest Service

Richard Ferranti

"An invention of the devil!" muttered Clearwater National Forest lookout Red Stewart as, once again, the complicated mirror and shutter of his heliograph went out of alignment.

The year was 1915 and the Forest Service's brief dalliance with Civil War blinkers and sunlight was a dismal failure (Coats 1984). Frustrated foresters needed to improve their ability to communicate, but radio technology would not be ready for the fireline for another 15 years.

Radio's Rustic Beginnings

The Forest Service began its exploration of radio shortly after Guglielmo Marconi demonstrated long-range wireless telegraphy at the turn of the twentieth century. The earliest radio equipment was bulky, heavy, and required huge antennas—requirements that limited its potential for practical field use. In 1916, an experimental forestry base station used wires strung across a 1,600-foot (488 m) canyon to explore this new technology (Slonaker 1916).

At the end of World War I, R.B. "Ring Bell" Adams, the same Forest Service engineer that equipped the Forest Service with its telephone network, began experimenting with radio. Although his communications trials were largely successful, the equipment was still far too heavy, unreliable, expensive, and bulky for practical use (Adams 1923).

"An invention of the devil!" muttered Clearwater National Forest lookout Red Stewart as, once again, the complicated mirror and shutter of his heliograph went out of alignment.

Beatty Introduces Radio to the Forest Service

In 1927, long-time forester Dwight Beatty demonstrated a small, crude, but effective radio to Forest Service Chief Forester Greeley and others during a convention in Missoula, MT. The group was intrigued by the prospect of radio communications on the fireline. Beatty, who had a keen interest in radio engineering but no formal training, was immediately charged with exploring this possibility.

A Shortwave Discovery

When Beatty interviewed east coast radio experts, they told him that low-powered portable transceivers could never communicate over mountains or through timber. Nevertheless, Beatty was not discouraged. After conduct-

Forest Service radio pioneer Dwight Beatty operating his SP-1930 (Semi-Portable) Morse Code transceiver. Eight of these units were produced for fireline communications and testing. Photo: Forest Service, James Allen collection, Los Altos, CA.

Richard Ferranti is a principal research engineer at SRI International in Menlo Park, CA. Previously, he was an associate group leader at MIT's Lincoln Laboratory in Lexington, MA.

ing many careful experiments, he found that with the right antenna and the right frequency band, his rugged portable shortwave radio could communicate over a 10- to 20-miles (16- to 32-km) range, with its signals hopping over treetops and mountains (Beatty 1931).

Radio Lab Pioneers Technology

Dwight Beatty's success led the Forest Service to open a radio laboratory in Portland, OR, in the early 1930s. Though its engineering staff never numbered more than 8, the radio lab pioneered the development of some of the 25 different Forest Service radio sets over the next 20 years. As technology continued to advance, each improved radio set fulfilled the same basic agency requirements—they were simple, rugged, and reliable (Gray 1982).

When Beatty retired in 1931, World War I Army Signal Corps veteran A.G. "Ags" Simson took the helm as lab manager and spokesperson. Simson, a skilled manager and radio engineer, helped his team design radios that were more stable and easier to set up, tune, and use. The era also brought about voice capability, replacing the Morse code telegraphy used with Beatty's first radio. (Simson 1935, 1938, 1941a, 1941b).

Since large eastern manufacturers were not interested in the small quantities of radio gear that the Forest Service required, local radio manufacturers in the Pacific Northwest produced the lab-designed sets and forestry lab personnel tested them.

Lightening the Load

By the mid-1930s, forestry lab engineers pushed the technology up in frequency from shortwave to the lower VHF bands, where ranges were limited to line-of-sight, but with much reduced noise and interference. The VHF radio, with its short antenna and light weight, was ideal for communication between fire scouts in mountaintop lookout towers and smoke chasers on the ground.

The new technology complemented the shortwave sets ability to span mountainous terrain without lookout tower relays. By the beginning of World War II, nearly 4,000 radios had been ordered, and these had become an essential part of Forest Service communications (Gray 1982).

The Forest Service Type PF "Portable Fone" operated by Richard Ogg, Lolo National Forest, 1933. The PF was one of the smallest and lightest of the shortwave radio sets, so popular that some 450 were deployed by the Forest Service before it was replaced by an improved model in 1935. Photo: Forest Service.

Long-time forester Dwight Beatty's interest in radio engineering helped establish a Forest Service radio laboratory in Portland, OR, in the early 1930s.

Radio Network and National Security

During World War II, Forest Service personnel used their radio network to report suspicious aircraft as part of the Nation's Aircraft Warning System. Though not publicized at the time, foresters reported and tracked balloon-borne Japanese firebombs that were sent thousands of miles across the Pacific Ocean in hopes of destroying the national forests (Strain 2005). Thanks in part to the Forest Service's effective radio network, not one of the dozens of balloons sighted caused significant damage.

Fireline Radios Evolve

Following the war, the radio lab contributed another major technical innovation by making VHF-FM radio practical for fireline communications.

Though FM had been developed and deployed in the war, it was Logan Belleville, a Forest Service Radio Laboratory engineer, who shrunk a heavy backpack-sized VHF-FM radio to a transceiver that could fit in the hand (Lawson 1946; Biggerstaff 1949). This communications marvel weighed just 9 pounds (4 kg), carried its own batteries, and contained no less than 27 subminiature vacuum tubes.

Big Industry Tunes In

By the late 1940s, companies like Motorola finally took notice of the Forest Service's advanced communications equipment and began developing their own. Their earliest models were largely based on the radio laboratory's designs.

Within a few years, the fledgling VHF-FM radio industry was in full production, manufacturing equipment that not only met the modest needs of the Forest Service but the huge civilian police, fire, and other public service markets.

With industry taking over as the lead radio manufacturers, the era of homegrown Forest Service radio design ended. The radio laboratory moved to the east coast in the early 1950s, becoming a center for working with industry, adopting their advancing designs to forestry needs, and testing the results. Today, the National Interagency Incident Communications Division in Boise, ID, continues to work with industry to develop and test communications equipment.

Forest Service Radio Legacy

The Forest Service has a significant legacy in radio communications technology. Beatty's original discovery and exploitation of short-range,

The Forest Service Type SF VHF-FM walkie-talkie, 1947. (Top right) Model A shown with its slide-out battery box. (Top left) Model C with external handset connector. (Below right) Inside the SF, showing its array of 27 tubes and intricate construction. More than 200 radio sets were made before commercial manufacturers began producing their own versions. Photo: Richard Ferranti.

During World War II, Forest Service personnel used their radio network to report suspicious aircraft as part of the Nation's Aircraft Warning System.

shortwave radio propagation to overcome mountain shadows and foliage loss is often unrecognized as a major contributor to wireless communications.

Short-range, shortwave radios, used in both World War II and Vietnam are still used today as an essential military and commercial communications technique (Austin 2000; Hagn 1966).

The radio laboratory's equipment consistently incorporated the latest technical developments and always adapted to the Forest Service's unique needs. The lab's emphasis on portability, ease of use, ruggedness, and reliability has saved lives and forests. It was also a seedbed for the "Silicon Forest," providing engineering talent for pioneering Portland electronics firms such as Tektronix and Electro Scientific Industries (Cortright 2000).

It's difficult to imagine that when the Forest Service was first established, foresters worked in near-total isolation, without access to rapid communications, nearby assistance, and resources in case of an emergency.

The Forest Service responded to that critical need with foresight and vigor, giving firefighters, foresters, and the community a radio capability unequaled in its time.

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Wildland Fire Use Barriers and Facilitators

Anne Black, Martha Williamson, Dustin Doane

The Forest Service authorizes broadscale wildland fire use (WFU) both inside and outside wilderness areas in many western forests; but, will agency authorization alone lead to implementation?

Understanding barriers and facilitators to WFU implementation is critical for establishing realistic program expectations and providing a foundation for any efforts to change program outcomes.

This paper synthesizes our current understanding of factors influencing WFU decisionmaking (see Table 1 for a summary of previous research). Our intent is to capture the fire community's dispersed wisdom and provide policymakers and decisionmakers with an objective basis for future actions designed to affect WFU program outcomes and effectiveness.

Methodology

Our background data come from:

- Previous formal studies (*<http://leopold.wilderness.net/staff/black.htm>)*,
- Two information collection team efforts organized by the Wildland Fire Lessons Learned Center,
- A series of targeted interviews, and
- Numerous discussions with members of the fire community.

Anne Black is an ecologist for the Aldo Leopold Wilderness Research Institute, Forest Service, Rocky Mountain Research Station in Missoula, MT; Martha Willliamson is a fire management specialist for the Humboldt-Toiyabe National Forest in Sparks, NV; and Dustin Doane is a Forest Service smokejumper at the McCall Smokejumper Base in McCall, ID.

Research suggests that a host of factors influence the go/no-go decision.

Table 1. *Considerations for fire use (WFU or prescribed) decisionmaking identified in previous studies.*

External political issues: Intergovernmental relationships; public support and knowledge about WFU, public attitudes, understanding, and level of trust in the agency; and smoke regulation. *Arno and Brown 1991, Cleaves and others 2000, Cortner and others 1990, Czech 1996, Daniels 1991, Parsons and Landres 1998, WFLLC 2005, WFLLC 2006.*
Internal policies: WFU authority, size of MMA, burn window prescriptions, whether adjacent landowners are accepting of WFU. *Cleaves and others 2000, Miller and Landres 2004, Parsons and Landres 1998, FMP 1995, FMP 2001, NWCG 1995, WFLLC 2005, WFLLC 2006, Zimmerman and Bunnell 1998.*
Biophysical considerations: Fuels, weather, topography, ignition location and timing, potential smoke production, potential fire behavior, and ease of control versus risk of escape. *Cleaves and others 2000, Miller and Landres 2004, Pyne 1995, NWCG 1995, WFLLC 2006.*
Economic considerations: Potential cost, availability of funding to restore structures and resources if damaged, potential cost savings, threats to private property, and potential WUI or other hazards. *Bonney 1998, Calkin and others 2005, Cleaves and others 2000, Czech 1996, Daniels 1991, Miller and Landres 2004, NWCG 1995, Zimmerman 2003.*
Natural resources: Potential for conflicting objectives, potential to achieve resource benefits, pose risks, potential to reduce fuels hazard. *Cortner and others 1990, Czech 1996, Miller and Landres 2004, Parsons and Landres 1998, White and others 2000, WFLLC 2006, Zimmerman 2003.*
Human resource considerations: Availability of qualified personnel and for extended periods, level of other fire activity, potential to minimize firefighter exposure to danger. *Arno and others 2000, Benedict and others 1991, Bonney 1998, Cleaves and others 2000, Cortner and others 1990, Daniels 1991, Miller and Landres 2004, NWCG 1995, Tomascak 1991, WFLLC 2005, WFLLC 2006.*
Individual decisionmaker considerations: Perception of program value, attitudes towards and experience with risk, and towards potential career consequences and legal liability. *Arno and Brown 1991, Arno and Fiedler 2005, Bradley 1995, Bunnell 1995, Calkin and others 2005, Daniels 1991, Jolly 1995, Kilgore 1991, Pyne 1995, Stanton 1995. van Wagtendonk 1995, Williams 1995, White 1991.*

Through two recent master's thesis projects (Williamson, Doane), we sought to determine which of the myriad factors (Table 1) affecting decisions to plan for or manage WFU are most important to fire staff making recommendations and line officers making decisions about wildland fire.

Factors Affecting WFU Decisions—from the Fire Staff's Perspective

Doane (2005) sought to understand WFU barriers and facilitators on all wilderness lands. He compared factors in areas where WFU was a management option to places where it was not. He focused on Forest Service district fire management officers and assistant fire management officers and their views on the issues surrounding Forest Service ranger districts with wilderness areas. Although Doane's survey response rate falls beneath statistical rigor at 14 percent, it remains the largest such investigation known. We present his results for the wildland fire management community to consider as it moves from WFU in wilderness only to WFU on all lands.

Table 2 summarizes responses to key survey questions. Respondents were asked to answer to what extent they felt particular statements were responsible for an outcome (the decision on the most recent candidate ignition, lack of authorization in a fire management plan, or lack of authorization in the land management plan).

Responses across all categories suggest significant biophysical constraints on WFU (e.g., location of ignition relative to locations where fire is not desirable, lack of natural ignitions). Such constraints are not likely to go away, although it is possible to ameliorate some of them, such as by making the built environment more fire resilient.

Responses also indicate the importance of coordination across ownership and management boundaries and the interconnection of landscapes and the significance of internal support for WFU. This latter is intriguing because while the former have gained management and research attention, this issue has not.

Supporting this finding, institutional support was most frequently mentioned as a *facilitator* by fire management officers located in areas where WFU is authorized (Table 3). Specific support cited as most useful included:

- Supporting the fire manager's decision,
- Encouraging WFU from higher levels,

What kinds of internal support of wildland fire use would be most useful?

Table 2. *Top barriers to wildland fire use (WFU) as identified by Forest Service wilderness fire managers (n = 72).**

WFU authorized	Not authorized in Fire Management Plan	Not authorized in Land Management Plan
Fire behavior likely to threaten boundary (9**)	Values at risk outside boundary (9)	Insufficient natural ignitions (11)
Fire behavior likely to result in negative resource outcomes (9)	Lack of time/resources to incorporate into FMP (9)	WFU not cultural norm (10)
		Values at Risk outside boundary (9)

*Sample drew 6-10 responses from every Forest Service region but Alaska. Table shows only those statements that garnered more than 30 percent of all responses in that outcome category (WFU authorized, not authorized in fire management plans, not authorized in land management plans).
**Number includes responses to questions asking to what extent a particular statement was responsible for the outcome and sums across positive extents: fairly, very, or almost entirely responsible.

Table 3. *Most frequently mentioned ideas for increasing use of WFU program described by Forest Service district fire management officers and assistant fire management officers in districts with wilderness responsibility (n = 68)*. (Adapted from Doane 2005.)*

	WFU authorized (n = 25)*	WFU not authorized (n = 13)*
Institutional support	11	2
Education	7	4
Flexibility	8	3
Increase lands available	5	2

*Number of responses to open-ended question regarding WFU program facilitators.

- Providing managers with incentives to use WFU,
- Counting WFU acres toward targets, and
- Protecting managers and their decision.

Facilitators most frequently mentioned by fire managers in areas where WFU is currently *not* authorized include: 1) educating internal and external audiences, including evaluating the adverse effects of suppression decisions and 2) increasing management flexibility, including allowing WFU even under high national preparedness levels, managing fires remotely, and changing Wildland Fire Implementation Plan Stage I timelines.

Line Officer's Perspective

Williamson (2005) addressed barriers and facilitators to WFU by asking how line officers make their go/no-go decision. She obtained a high response rate (85 percent) among a study population of district rangers with existing WFU authority in the Forest Service's Northern Region, Southwest Region, and Intermountain Region.

Williamson's analysis revealed that the primary factor differentiating district rangers likely to use WFU from those who are not is the ranger's perception of the WFU program's value. A high level of trust in the ranger's staff was also important.

On the other hand, top considerations that inhibit the WFU go decision included:

- External factors such as time of year, fire danger indices, ignition location, threatened and endangered species;
- Public perception; and
- Human resource availability and the lack of resources (ground and aerial), WFU qualifications, and agency support.

Williamson's results mirror research from other industries that show productivity is positively correlated to alignment with organizational values and priorities (cf. Vogus 2004) and suggests that any changes in WFU program outcomes will require attention to how organizational values are articulated, prioritized, and transferred to line officers.

> Changing program outcomes of wildland fire use will require attention to how organizational values are articulated, prioritized, and transferred to line officers.

Summary of Factors

Graphical representation of the myriad facilitators and barriers highlights their distribution across economic, social, and ecological realms (fig. 1). These factors include characteristics of individuals and organizations at district, forest, and national levels, as well as broader political and public attitudes.

From our work, the following appear to be key influences on program productivity:

- Biophysical constraints and public perceptions,
- Internal human resource capacity and availability,
- Internal agency support, and
- Individual commitment to the WFU program.

Further analysis of the relative influence of these factors on WFU programs might be necessary to guide or support future policy actions. (Figure 1 provides testable hypotheses.) However, a number of policy changes in 2005 have already started to address some of these barriers by creating a more supportive environment for fire use. These include:

- Changing policy, such as increased time for making the initial go/no-go decision (Stage I of the Wildland Fire Implementation Plan) from 2 to 8 hours, a new Wildland Fire Implementation Guide, more WFU capacity through additional training, and discussions to define interagency definitions for fire use modules;
- Increasing the number of authorized acres through amendments to existing, and the development of new land management plans, as well as frameworks and tools for assessing potential resource benefits and risks from fire;
- Addressing resource availability by allowing type 2 teams to manage WFU events and by placing long-term fire behavior analysts (LTAN) on these teams, sharing fire use managers (FUMA) among several events, allowing type 4 incident commanders to manage low-complexity WFU events, and placing emphasis on mentoring to build line officer confidence and experience with WFU;
- Increasing internal support and communication, facilitated by the Wildland Fire Lessons Learned Center, to share lessons learned, collect and distribute effective practices, and promote skill and knowledge through sponsorship of "Managing the Unexpected" workshops and after action reviews; and

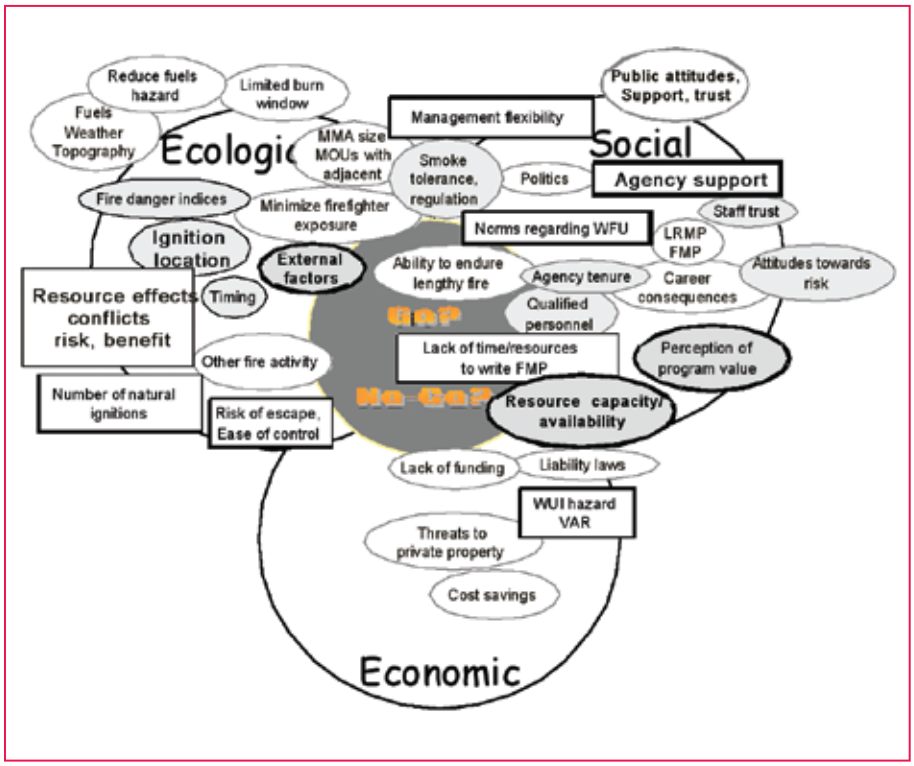

Figure 1. *Considerations for wildland fire use mentioned in the literature highlighting aspects of potential greatest significance from the perspective of Forest Service staff and managers with responsibility for wilderness areas. Rectangles indicate considerations from Doane 2005. Shaded ovals indicate results from Williamson, 2005. Bold fonts indicate convergence across studies, with heavier borders indicative of greater weight.*

- Increasing support for line officers when success is less than expected, changing policy, such as the Implementation Guide, and sponsoring workshops to build skills.

These changes highlight the dynamic nature of fire management and the rapidity with which at least some changes can be made. Changing the organizational culture will take longer, in part because changes related to the social environment—relationships, values, culture, organizational leadership—have received the least attention to date.

Acknowledgements

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Roscommon Equipment Center

Looking for information about firefighting equipment? We may be able to help.

Kirk Bradley

Rosscomon Equipment Center Program

A History of Service

The Roscommon Equipment Center (REC) was first formed in 1972 as a joint venture between Michigan Department of Natural Resources Forest Fire Experiment Station and the Northeast Forest Fire Supervisors.

Since 1929, the Forest Fire Experiment Station has operated as a wildland fire equipment development center. The station began in an era when motorized vehicles were in their infancy, and the facility's blacksmiths were modifying horse-drawn agricultural equipment to use to combat wildfires. That dedication to wildland fire suppression equipment has continued to flourish through the REC program.

Kirk Bradley is a Roscommon Equipment Center program administrator, an engineer manager, and the Forest Fire Experiment Station unit leader in Roscommon, MI.

In the early years, REC was centered on a new program that allowed the Federal Government to loan excess equipment to State wildfire agencies and rural fire departments.

REC and FEPP Make It Happen

In its early years, REC was centered on a new program called the Federal Excess Personal Property (FEPP) Program that allowed the Federal Government to loan excess equipment to State wildfire agencies and rural fire departments.

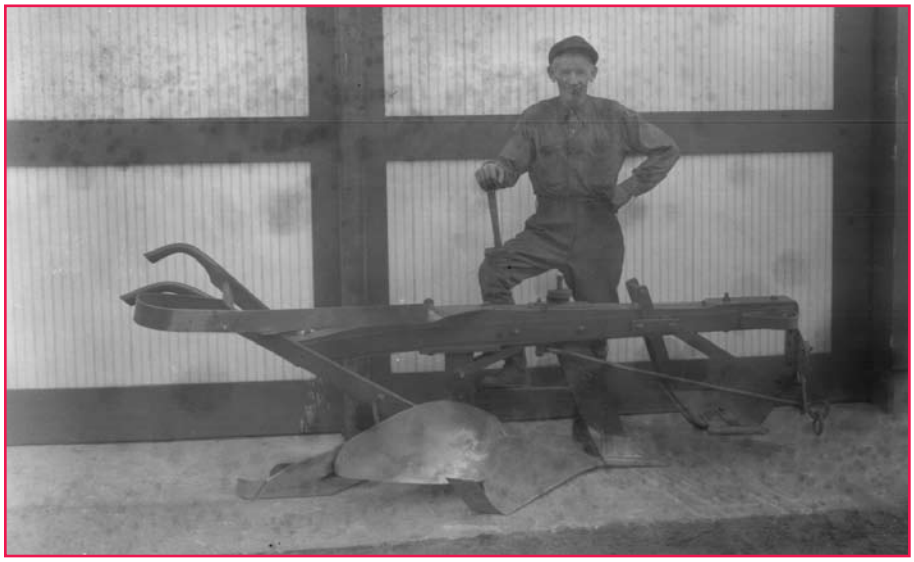
Photo 2—*Converted FEPP 6x6 wetting down fuels along a plow line.*

The FEPP program gave State and local agencies access to heavy-duty off-road vehicles that, until then, were only available to the U.S. military. While these units were in their later years of expected life, and designed for a specific military purpose, the base units had the essential components that, with modification, would expand the fire suppression effectiveness of many agencies.

The surplus equipment did not come without some interesting challenges. Many agencies struggled to use the equipment because it required modifications to be serviceable.

Once the modifications were completed, the agencies still had misgivings about the safety, reliability, and effectiveness of their newly acquired equipment.

This need of expertise is one of the main reasons REC was formed—to assist in making safer and more reliable alterations.



Horse drawn agricultural plow modified for use in a harsh forest environment. Photo: Roscommon Equipment Center.

National Association of State Foresters

Since 1999, the National Association of State Foresters (NASF) has sponsored and provided funding for the REC program to ensure that the program's resources remain available to all 50 States. Working with the equipment available through the FEPP program has also remained an integral part of the REC program.

REC's primary objective is to provide assistance to State agencies and rural volunteer fire departments, many of which operate on limited budgets. The dedicated staff of REC continues the innovation legacy using state-of-the-art equipment to develop modern-day firefighting prototypes and sharing the information throughout the United States. The program provides engineering and fabrication advice, which includes an Internet forum for those seeking information, and for those presenting new ideas about fire suppression equipment.

For more than 35 years, REC has assisted wildland fire agencies by developing prototypes and conversion plans for nearly all rolling stock available through the FEPP program.

Recycling FEPP program equipment for wildland fire use is just one example of the program's many accomplishments. REC's expansive designs range from fabricating a remote control turret that shoots water in a 360-degree range while the operator sits in the engine, to a collapsible heavy-duty leaf rake that is compact enough for storage, but sturdy enough for raking hardwood debris for fireline construction.

Developers have created or tested some unexpected items also—how about a walnut husker? Or, perhaps you have a need for a cooling system for your Smokey Bear suit. Visit the REC Web site for other unique innovations.

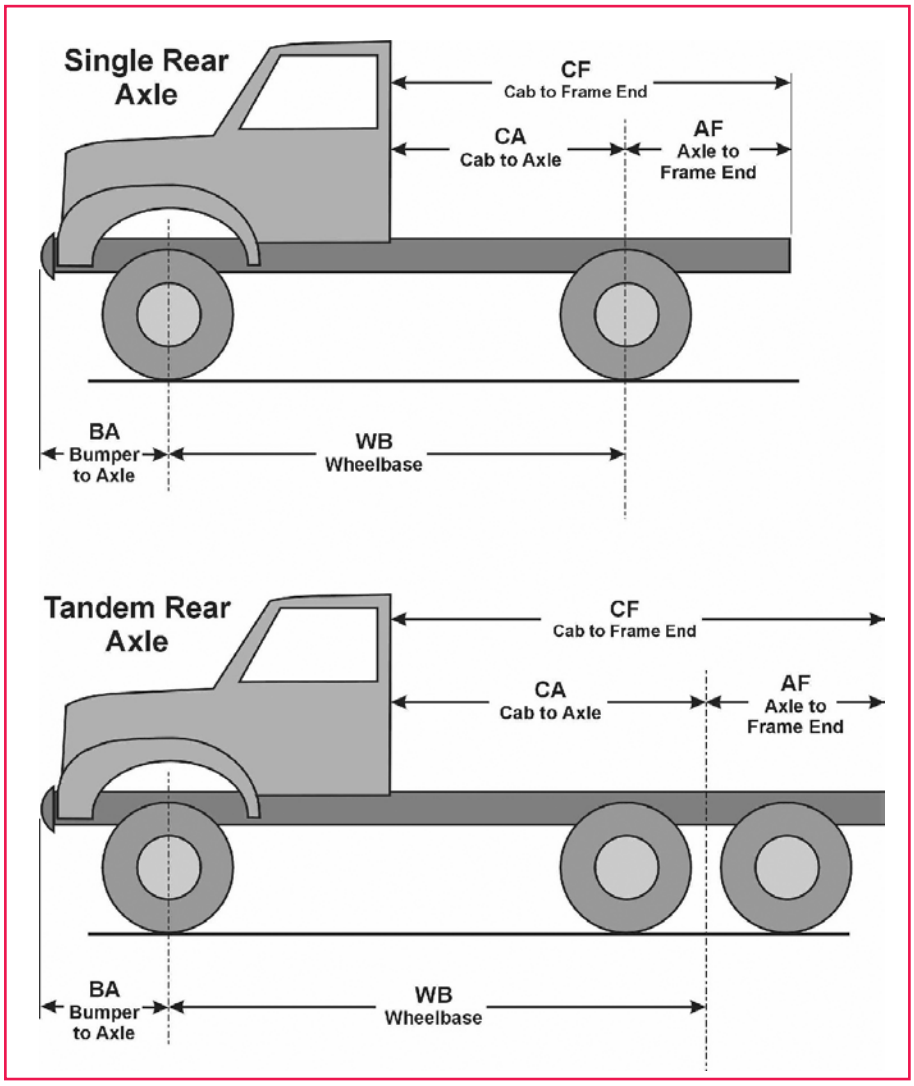


Figure 1—*Standard nomenclature for truck dimensions.*

REC Resources, Products, and Programs

Few people staff the program, but the small group collectively represents decades of expertise in engineering, drafting, and fabricating.

The shop is extensively equipped, capable of producing precision machining, forming, and welding of steel and a variety of exotic metals and plastics.

Although REC could potentially manufacture equipment that is not part of the program, their craftsmen produce prototype equipment solely for the purpose of testing, evaluating, and reporting the information. Upon request of wildfire agencies, the staff also tests commercial equipment and then reports upon those conclusions.

Collapsible fireline rake. Photo: Roscommon Equipment Center.

To assist the program in testing the prototype equipment and fire suppression chemicals, the State of Michigan set aside 6,000 acres (2,400 ha) of land for that purpose. Here, the staff can try out their prototype units and conduct research in a wide variety of terrain and forest conditions.

REC works earnestly to disseminate information to meet the needs of their customers. With the help of desktop publishing, digital video, still photography, and a comprehensive Web site, the staff converts their designs and testing conclusions into publications reaching a wide audience. Each REC publication describes intricate details about their prototypes, specifications, or evaluations of building safer and more effective fireline equipment. The staff is available for personalized one-on-one help as well.

The REC Web site (<http://www.RoscommonEquipmentCenter.com>) receives more than 4,000 visitors each month, significantly expanding the availability of the programs research and development reports.

The site is organized in such a way to make it easy to search and download information. There are several links on the site, including one that provides information about FEPP equipment such as manuals, original and aftermarket replacement parts and optional equipment, and maintenance tips.

Each year the REC program invites a small group of State and Federal equipment managers to an equipment workshop to introduce the program and demonstrate the available resources.

The workshop includes a tour of the facility and the attendees can try out the various pieces of firefighting equipment. The Ontario Ministry of Natural Resources also provides a tour of their Aviation and Forest Fire Equipment Resource Management Center in Sault Ste Marie, Ontario, Canada, giving the workshop an international flare.

Workshop attendees represent a wide variety of U.S. wildland firefighting agencies. Taking advantage of this diverse group, all attendees are asked to present information about their agency, their successes, and their needs. Most find that the presentations and the attendee interaction are as valuable as the workshop itself.

With assistance from the NASF and State wildland fire agencies, the Roscommon Equipment Center provides wildland firefighters with resources to perform their job more safely and successfully.

Representing State Wildfire Agencies

Because the REC program is sponsored by the NASF and serves all State wildland fire agencies, the REC staff is often asked to be national representatives, collecting information and expressing concerns on the behalf of the agencies.

Currently, the staff participates in the National Wildfire Coordinating Group's Fire Equipment Working Team (FEWT), the FEWT Mobile Fire Equipment Task Group, the National Fire Protection Association, and other industry standards organizations.

REC staff also works closely with private industry, keeping abreast of commercial equipment that might be useful in the wildland firefighting community. By monitoring changes and updates in existing equipment, and keeping an eye out for new equipment, REC helps keep the fire community up-to-date.

REC in the Future

During the last few decades, REC has evolved along with the changing needs of the wildland firefighting community. With assistance from the NASF and State wildland fire agencies, REC remains firmly dedicated in providing wildland firefighters with resources to perform their job safely and successfully—REC is here to serve!

Related Web sites:

NASF: <http://www.stateforesters.org>
NWCG: <http://www.nwcg.gov>
NWCG Fire Equipment Working Team: <http://www.nwcg.gov/teams/fewt/index.htm> ■

Florida Volunteer Fire Departments Receive Hurricane Grant

Matt Weinell

In August and September 2004, four hurricanes damaged an estimated 3.9 million acres (768,930 ha) in all 67 Florida counties.

The resulting debris increased fuel loading and the imminent danger of wildland fires. In addition to the high fire danger, Florida's Division of Forestry found its access to some hard-hit rural areas severely limited. Equipment was urgently needed to help Florida's community volunteer fire departments get a handle on the situation.

Working Together

Small volunteer fire departments are the backbone of rural firefighting. The devastation of the 2004 hurricane season left many local communities especially vulnerable to large fire outbreaks due to the extreme fuel loads. Modest firefighting resources and equipment, usually adequate to fight fire in small communities, were simply insufficient to fight a fire should an ignition occur under these conditions.

To help outfit the smaller brush trucks that volunteer fire departments operate, the Florida Division of Forestry, in cooperation with the Forest Service, established a pool of slip-in skid units with foam capability using supplemental funds from a matching grant program established by Congress.

Matt Weinell is a fire resource manager for the Florida Division of Forestry, Tallahassee, FL.

Greenville Volunteer Fire Department, 200-gallon(757-L) skid-mounted unit with foam capability. Photo: Elijah Terrell, Florida Division of Forestry, 2006.

Following the severe 2004 hurricane season, the U.S. Congress passed legislation to provide the Forest Service's Southern Region with funds to mitigate the effect of hurricanes and other weather-related disasters in rural communities.

Volunteer fire departments from all counties in Florida submitted applications for the skid units. Areas that had suffered the highest sustained winds during the recent hurricanes or those that had experienced damage from multiple storms were considered first.

Similar to the Volunteer Fire Assistance Grant Program, applicants for the hurricane grant funds were eligible if they were the only volunteer fire department serving a rural community of less than 10,000 people and had an existing partnership agreement with the Florida Division of Forestry.

The Slip-in Skid Solution

A skid-mounted fire-suppression system can be installed in a heavy-duty truck bed for dispersing water

Anatomy of a Slip-In Skid Pump

- Pump: Darley model 1-1/2 AGE 20H, centrifugal, single stage design, with a capable discharge of 120 gallons per minute at 130 pounds per square inch.
- Engine: Honda GX620, air-cooled 20 horsepower, V-twin, overhead valve.
- Water capacity: 200-gallon (757-L), 300-gallon (1,135-L), 500-gallon (1,893-L).
- Foam system: Foam Pro model 1601 Hale 1.0 V Series Foam Master.
- Total unit weight: 2,750 to 5,200 lbs (1,334 to 2,668 kg) when full.
- Cost: $14,300 to $15,500 each.

and foam for fire suppression. The tanks are constructed of high-quality, one-half inch (1.27 cm) black polypropylene sheet stock coated with a resin. The material is thermoplastic, noncorrosive, stress relieved, and has an ultra violet stabilizer for maximum protection. "That means they are basically pretty light and very durable," said Ira Jolly, Division of Forestry fire chief of Tallahassee, FL.

"We distributed twenty-six 200-gallon (757-L) slip-in skid units, twenty-six 300-gallon (1,135-L) units, and twelve 500-gallon (1,893-L) units to rural fire departments across Florida. These units were valued at more than $941,000," said Mike Long, director of the Florida Division of Forestry. With this equipment on hand, local firefighters can, in most cases, arrive on the scene quickly and have a better chance of containment.

The Payoff

Although it took patience to wait for the completed slip-in skid units to be built, delivered, and matched up with the appropriate fire truck, the ability of Florida's volunteer firefighting departments to appropriately and quickly respond is much improved. "We would like to especially thank the Forest Service's Southern Region, Fire and Aviation folks for their persistence in making this grant program a success," said Jim Karels, assistant director of the Florida Division of Forestry, "Without their continued support and oversight, it just wouldn't have been possible." ■

Web Sites on Fire*

The Firefighter Program (FFP) a huge success for many States!

The Department of Defense (DoD) and the Forest Service have joined forces in sending excess DoD property to State agencies and volunteer fire department to assist them in firefighting and emergency services. As of September 2007, 23 States have signed agreements with the Forest Service to participate in this program.

Those participating have received property valued at more than 50 million dollars. Several other States are currently working with their State legislators to partake in this worthwhile program.

For information about the FFP program and a listing of the State representative, visit the following Web site: **<http://www.fs.fed.us/fire/partners/fepp/DODprogram/index.html>**

* Occasionally, *Fire Management Today* briefly describes Web sites 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 Forest Service. To have a Web site described, contact the managing editor, Cindy White, at Forest Service, Darrington Ranger Station, 1405 Emens Avenue North, Darrington, WA 98241, 360-436-1155 (tel.), 360-436-1309 (fax), cwhite@fs.fed.us (e-mail).

Federal Excess Equipment Recycled

Melissa Frey

Having the right equipment for firefighting is not only necessary—it's essential. Since 1954, the Forest Service has helped State agencies acquire usable, surplus equipment through the Federal Excess Personal Property (FEPP) Program to meet their firefighting needs.

The vehicle pictured below is an M-977 Heavy Emergency Tactical Truck, known to military personnel as a HEMTT (pronounced hem-it). This 1988, eight-by-eight cargo vehicle, manufactured by Oshkosh Truck Corporation, was once used for hauling military cargo.

In 2001, the Pennsylvania Bureau of Forestry acquired this piece of equipment through the FEPP program and quickly transferred it to the Wiconisco Fire Engine Company No. 1 of Wiconisco, PA.

Melissa Frey is the Issue Coordinator, Fire Management Today, *Washington DC*

This 2,000-gallon (7,571 liter) tanker is a 1972 AM General that came from Camp Robinson in North Little Rock, AR. The State of Arkansas serviced it and installed a tank, then painted and lettered it before issuing it to the Cornerville Volunteer Fire Department in Arkansas.

The Wiconisco Fire Department had an urgent need for a tanker and had the means to refurbish the newly acquired HEMTT.

The vehicle is now equipped with a 3,000-gallon tank (11,356 L), Hale 250 gallon per minute (GPM) pump, and 600 ft (183 m) of hose. The tank has a quick-dump system, which means that the unit can dump a full tank in less than 3 minutes.

The total cost of making this truck into a valuable piece of firefighting equipment was $10,036. Photos: Randy Pogue of Arkansas Forestry Commission.

Many local businesses of Dauphin County, PA, donated the materials and equipment to refurbish this massive tanker. The total cost was less than $12,000. Photos: Charlie Choplick, Pennsylvania Bureau of Forestry.

U.S. Department of Defense Firefighters Program

Yet another source of surplus fire equipment comes from the U.S. Department of Defense (DoD). The DoD disposes of millions of dollars worth of excess equipment annually. Through a memorandum of agreement, the Forest Service assists State firefighting agencies in acquiring excess DoD property to be recycled into effective firefighting equipment.

Since March 2006, the DoD Firefighter Program (FFP) has acquired property to be used for firefighting and emergency services. A typical piece of equipment ready for recycling might be a truck in need of repair. State agencies take such equipment, repair it, refurbish it, and turn it into a quality firefighting resource. ■

Technology and Development for the 21st Century

Serving Wildland Firefighters since 1945

Ruth Paz

The Forest Service Technology and Development Centers (formerly the Equipment Development Centers) program began shortly after World War II. Its mission was, and still is, to provide nationwide leadership in the development, testing, analysis, standardization, and evaluation of equipment, materials, and procedures for the protection and management of national forests and grasslands. Originally established in Arcadia, CA, in 1945, the operation moved to San Dimas, CA, in 1965 and became known as the San Dimas Technology and Development Center (SDTDC).

> Providing nationwide leadership in the development, testing, analysis, standardization, and evaluation of equipment, materials, and procedures for the protection and management of national forests and grasslands is the mission of the Forest Service Technology and Development Centers.

In the late 1940s, a group of engineers working on the initial needs of the Forest Service smokejumper program were organized into the Missoula Equipment Development Center in Montana. This operation eventually became the Missoula Technology and Development Center (MTDC).*

Ruth Paz is a mechanical engineer at the Forest Service's San Dimas Technology and Development Center in San Dimas, CA.[1]

[1] Ralph Gonzales, fire program leader, and Bert Lindler, supervisory technical writer/editor, at Missoula Technology and Development Center, were major contributors to this article.

*For more information on the Missoula Technology and Development Center, please refer to the article on page 24.

Crew field analysis are used to determine accuracy of current production rates contained in the Fireline Handbook (410-1). Accurate production rates are essential for crew safety, planning, and cost-effective firefighting efforts. Photo: SDTDC.

Today, the SDTDC and MTDC are the two locations that form the Forest Service Technology and Development Centers.

Current Projects

Crew Production Rates—The production rates for hand crews and equipment listed in the Fireline Handbook (410-1) and other publications were developed 30 years ago and, at that time, were accurate. However, for some years, many in the fire community have questioned the validity of the rates. SDTDC is leading the effort to test the existing crew production rates and establish new ones, if necessary.

Updated production rates help fire managers understand which types of new equipment would be most cost effective for fire suppression. Accurate rates also help during the planning stage of an incident by providing fire managers with the information to determine expected crew progress and plan accordingly for the next shift. For crew supervisors, accurate production rates help ensure that crews are building line within their abilities, keeping their safety priority.

Spark Arresters—SDTDC has the only spark arrester laboratory in the country. The center manages the spark arrester qualifications program to reduce fire starts caused by internal combustion engines. All qualified products are listed in a two-volume Spark Arrester Guide. Currently, a significant number of States, municipalities, and federally managed lands require that all internal or external combustion engines be equipped with a spark arrester that meets the requirements as specified in the guides.

SDTDC is leading the effort to test the existing crew production rates and establish new ones, if necessary.

Water-handling equipment—Pumps, fire hose, nozzles, wye valves, and tees are tested and qualified at the SDTDC. Water-handling equipment sold to the Forest Service and used by wildland firefighters must meet 26 water-handling specifications as established by the center.

SDTDC engineers periodically review specifications to ensure that the requirements are valid and to look for ways to improve the final product. The Water Handling Equipment Guide promotes standardization among agencies, which results in reduced equipment costs and increased efficiency and safety.

Engines—The National Wildland Fire Engine Committee, formed in 1997, is staffed by experts in the fields of engineering, fire, fleet, and safety. The committee provides the Forest Service with flexible engine-standard guidelines to help meet unique regional needs.

SDTDC performs inspection and performance evaluations on the engines and updates the guide, as appropriate. Field users of the engines are encouraged to invite industry participation in evaluating and updating this guide.
Due to the nature of fire engines and the way they are often used during emergencies on rough roads

Tilt Table used to conduct Forest Service engine performance evaluations. Photo: SDTDC.

Help us help you by submitting project proposals:

- Submit your idea electronically, <http://fsweb.sdtdc.wo.fs.fed.us/pubs/proposal/online.shtml> (Internal Forest Service only)
- Request a proposal form by phone (909) 599-1267 or fax (909) 592-2309

If you have any questions about your proposal, please call us and we'd be happy to discuss it with you.

and in harsh conditions, vehicle stability is extremely important. SDTDC developed a tilt table to test and qualify fully loaded vehicles.

Invasive Species—The transfer of invasive and nonnative species is an ongoing problem for fire management staff and other land managers. SDTDC is working with the U.S. Department of Defense and Montana State University (MSU) to address this growing problem.

SDTDC is evaluating vehicle-washing systems and developing a specification for the equipment. The MSU and SDTDC effort will lead to a standardized performance requirement for vehicle-washing equipment to help prevent the transfer of invasive or nonnative plant species.

Fire Shelters—Every Federal firefighter carries a fire shelter, so continued development of this piece of personal protective equipment is one of the most important projects at MTDC. A new generation fire shelter that provides additional flame protection has been developed and tested. The latest information on development of this tool is available in the Tech Tip "What's New With the New Generation Fire Shelter?"

Smokejumper Equipment—MTDC is developing a new lightweight helmet and mask for smokejumpers. In addition, the center is developing training videos to help smokejumpers better handle parachute malfunctions. The videos will include footage taken by cameras mounted on dummies equipped with parachutes rigged to malfunction. The footage shows smokejumpers exactly what they would see during similar malfunctions.

Fuel Safety—All firefighters handle fuel, so it is important they know how to do so safely and legally. MDTC has developed the draft "Interagency Transportation Guide for Gasoline, Mixed Gas, Drip Torch Fuel, and Diesel."

An Invitation

The Forest Service Technology and Development Centers welcome communication with other agencies and cooperators. The staff of engineers, foresters, technicians, scientists, and other specialists at the SDTDC and MDTC is available to provide technical solutions to fire management issues.

The Forest Service Technology and Development Centers have unique talents and expertise to improve the safety, efficiency, and operational effectiveness of the work environment of those in the fire community.

Guides, tech tips, and reports prepared by both centers are on the Web site at: <http://www.fs.fed.us/t-d/programs/fire/
Username: t-d
Password: t-d
Just click on the "T&D Pubs link." ■

Missoula Technology and Development Center Looks at Ways To Improve the Health, Welfare, and Performance of Firefighters

Tory Henderson

The Missoula Technology and Development Center (MTDC) is one of four detached units of the Engineering Staff in Washington, DC, and serves Forest Service regions and cooperating Federal and State agencies. MTDC works in cooperation with universities, private firms, and research groups to solve firefighter safety, health, and welfare problems; to advance existing technology; and to build and test prototype firefighting equipment for safety standards.

Early Physical Fitness Studies

As early as 1965, the Missoula Equipment Development Center—in cooperation with the University of Montana Human Performance Laboratory—began studying the energy, cardiovascular, and thermal demands of wildland firefighters. These early experiments set the stage for today's stringent health screening standards and the realization that firefighter performance is dependent on proper nutrition and adequate rest.

Tory Henderson is the fire equipment specialist who oversees the equipment and chemical program for the Forest Service, Washington Office, National Interagency Fire Center (NIFC) located in Boise, ID. Prior to that, she served as the Forest Service Administrative Manager at NIFC and was involved with incident operations and military, interagency, and international fire programs.

As the Forest Service has evolved, firefighting tactics, training, skills, knowledge, and equipment have always supported one steadfast theme—firefighters and public safety.

Work Capacity Tests

Field studies of fitness requirements for firefighters initiated the concept and development of the work capacity test. The first work capacity test, known as the Step Test (measuring heart rate following a 5-minute stair step-like test), estimated the minimum aerobic fitness standard needed for wildland firefighting duties. The Step Test remained the standard from 1975 through 1998 and was adopted and implemented throughout all wildland fire agencies and supported by the National Wildfire Coordinating Group (NWCG).

In 1998, the NWCG adopted new work capacity testing to replace the standardized step test. Each test measures an individual's ability to meet the minimum standard of fitness required to perform in his or her particular work. Three tests evaluate various degrees of performance for firefighting duties:

1) Pack Test, for difficult activity, is measured by a 3-mile hike, with a 45-pound pack, completed in 45 minutes;
2) Field Test, for moderate activity, is measured by a 2-mile hike, with a 25-pound pack, completed in 30 minutes; and,
3) Walk Test, for light activity, is measured by a 1-mile hike, with no pack, completed in 16 minutes.

The Pack Test and Field Test incorporate elements of muscular fitness while maintaining a set aerobic fitness standard, while the Walk Test (light) determined a lower level of fitness required for less demanding firefighting positions, such as office work with some field visits.

Fatigue management and adequate nutrition are important components of the health, welfare, and performance of the firefighter.

The work capacity tests, accompanied by a physician health screening, identifies conditions that may pose a threat to an individual prior to performing his or her job. Any potential health issues identified are evaluated to determine whether the individual is capable to perform the tasks necessary for the job.

Work, Rest, and Diet

Fatigue management and adequate nutrition are important components of the health, welfare, and performance of the firefighter. When following the work-rest guidelines (1 hour of rest for every 2 hours worked), firefighters should obtain proper rest, manage fatigue, and meet dietary needs to maintain peak performance throughout each day.

Research shows that firefighters who manage fatigue while on assignment report fewer illnesses. MTDC and NWCG continue to research and evaluate the effectiveness of the work-rest guidelines and dietary needs of firefighters.

In the 1950s, meals for firefighters consisted of C-rations or Meals Ready-to-Eat (MREs). Although MREs are still around today (mainly used for supplementary food while on the fireline), most fire camps provide firefighters with catered meals. National Mobile Food Services Contract caterers are required to meet predetermined nutritional and caloric requirements of *5,800* kilocalories per day for each firefighter.

Look for changes in the National Mobile Food Services Contract to meet changing dietary needs.

Analysis has shown that vitamin and mineral supplements can also assist in managing fatigue. However, the best way to meet the increased energy and nutrient demands of wildland firefighting is with a balanced diet based on a variety of foods. Dietary needs of firefighters include carbohydrates and protein-rich foods, nine or more servings of fruits and vegetables, and several servings of whole grains daily.

As firefighter dietary needs change, you can expect changes to the National Mobile Food Services food requirements.

Water

Hydration is an important element for the firefighter and continues to be evaluated as to the best combination of water and carbohydrate/electrolyte beverages to avoid fluid loss, fatigue, and heat stress.

Future studies will evaluate the relationships among diet, fitness, and immune function. Look for the development of a nutritional guidance program and the potential introduction of a ration component to meet micronutrient needs.

Additional information surrounding the health and safety of the wildland firefighter can be found in numerous Tech Tips and the Wildland Firefighter Health and Safety Report publications available through the MTDC or at <http://www.fs.fed.us/eng/t-d.php>. (User Id: t-d, password: t-d) ■

Fires in the High Cascades

New Findings for Managing Whitebark Pine

Michael Murray

Whitebark pine is a keystone species supporting a variety of high-mountain flora and fauna. Each year several million tourists and recreationists experience the beautiful forests while visiting ski areas, rustic lodges, and backcountry trails of western national parks and forests (Murray 2005). These picturesque timberline trees are popular subjects for postcards, artwork, and interpretive signs.

Alarmingly, in some locations, the nonnative blister rust disease and an ongoing mountain pine beetle epidemic have killed entire stands of whitebark pine (Kendall 1998). After nearly a century of fire exclusion in the high elevations of the Cascade Range (extending from southern British Columbia through Washington and Oregon to northern California), the question arises whether whitebark pine is being impacted by lack of fire. Over the past several decades, whitebark pine has become one of the most threatened trees in the Western United States.

Conserving whitebark pine is a high priority for land management agencies. Many States and Provinces are working toward developing tools such as fire, genetics, and silviculture to aid in this conservation effort.

Michael Murray, Ph.D, is a terrestrial ecologist for Crater Lake National Park in Oregon.

Whitebark pine is a valuable high mountain resource that fire managers can help protect and prosper. Photo: USDI National Park Service.

We found fire to be a common, yet complex element of whitebark pine forests of the Cascades during the past several centuries.

Understanding Fire's Role

Understanding fire regimes and the existing conditions is the first step towards reintroducing fire in the high elevations of the Cascade Range. Research studies have provided a clearer understanding of fire regimes in the Rocky Mountains (Arno and Peterson 1983, Murray and others 1998); however, little research has been performed in the distinctly different Cascade Range.

Cascade Range Study

Our research group began the Cascadian whitebark pine study with these objectives in mind: to gain an understanding of the Cascade Range fire regimes as associated with whitebark pine forests; to describe the historic and existing stand conditions; and to estimate potential ecological effects of fire exclusion policies.

The study area focused on Mount Rainier, North Cascades, Crater Lake National Parks, and adjacent national forests. Sixty plots from 55 distinct sites were inventoried, each site having at least 25 percent or greater canopy coverage of whitebark pine in relation to other tree species.

Field researchers examined the tree rings on partial cross-sections sawn from 57 fire-scared tree boles.

An additional 700 increment cores (pencil-sized samples bored from the tree by using a specialized coring instrument) were examined.

Diverse Fire Regimes

We found fire to be a common, yet a complex element of whitebark pine forests of the Cascades during the past several centuries. The presence of charcoal in 88 percent of the sample illustrates fire's nearly ubiquitous role.

Of 101 fire events detected, we dated 57 percent directly from fire scars, often supported by the surrounding stand age reconstruction. Thirty-seven percent were dated from stand reconstructions with no corresponding data from fire scars. Historical sources and field observations verified the remaining 6 percent of fire events.

Cascadian whitebark pine forests support an impressive range of fire frequency. We detected fire return intervals for every 10-year class up to 160-169 years (fig. 1). Sixty-seven percent of fires occurred at 9- to 90-year intervals. However, an additional 18 percent of plots supported evidence of only a single fire—suggesting longer, even multi-century intervals.

Fires often fail to leave discernible evidence. It is possible that sampling missed some events, thus overestimating fire interval lengths. This potential shortcoming is inherent to fire history research (Agee 1993).

Comparing Fuels and Fire Frequency

The wide range of fire intervals explains the variety of site and fuel conditions encountered. Statistically, we found significantly shorter fire intervals with increasing latitude.

The wide range of fire intervals explains the variety of site and fuel conditions encountered.

The northern Cascades tend to support more complete understory vegetation cover, providing more surface fuels. For example, the pinegrass communities of the north averaged more frequent intervals than the dryland sparse grass to the south (Table 1).

Examining the most recent burn at each site, we found that 56 percent were high severity events and 44 percent were low severity. When we went back in time to consider all burns evident at each site (101 total), 54 percent were low severity and 46 percent were high severity.

Evidence demonstrates repeated fires within many stands alternated between lethal stand-replacing events and relatively low severity

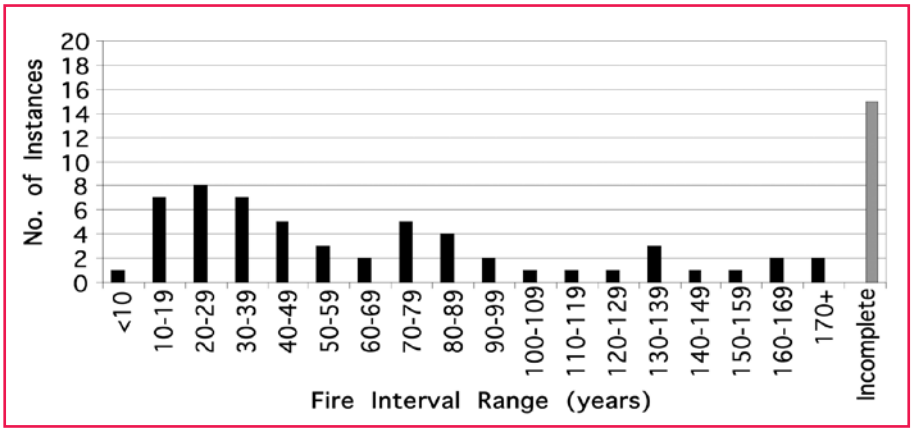


Figure 1—*Distributional frequency of fire intervals from plots. Last bar denotes instances where only a single fire was detected (incomplete interval).*

Table 1—*Comparison of fire intervals for each forest community based on dominant understory.*

Dominant Understory Vegetation	No. of Sites	No. of Intervals	Standard Deviation (of the Intervals)	Average Interval (Years)*
Pinegrass	3	9	39	44
Dwarf Huckleberry	20	25	48	55
Mountain Juniper	3	5	44	64
Green Fescue	5	9	57	84
Dryland Grass	12	10	86	93
Pinemat Manzanita	4	1	-	130
Extremely Sparse	8	0	-	>250 years

*Multiple-site average fire intervals (Barrett and Arno 1988)

burns, which left most trees alive. The casual observer will often notice these stands are composed of multiple-age classes. Thus, Cascadian whitebark pine forests provide excellent examples of mixed severity regimes.

The impressive breadth of severity and frequency mirrors the character of whitebark pine forests. The complex biophysical nature of the subalpine zone is undoubtedly the driver behind this. Local weather, aspect, slope, fuel patchiness, and stand structure interact forming a diverse milieu over short distances. As such, fire regimes are as site-specific as they are species-specific.

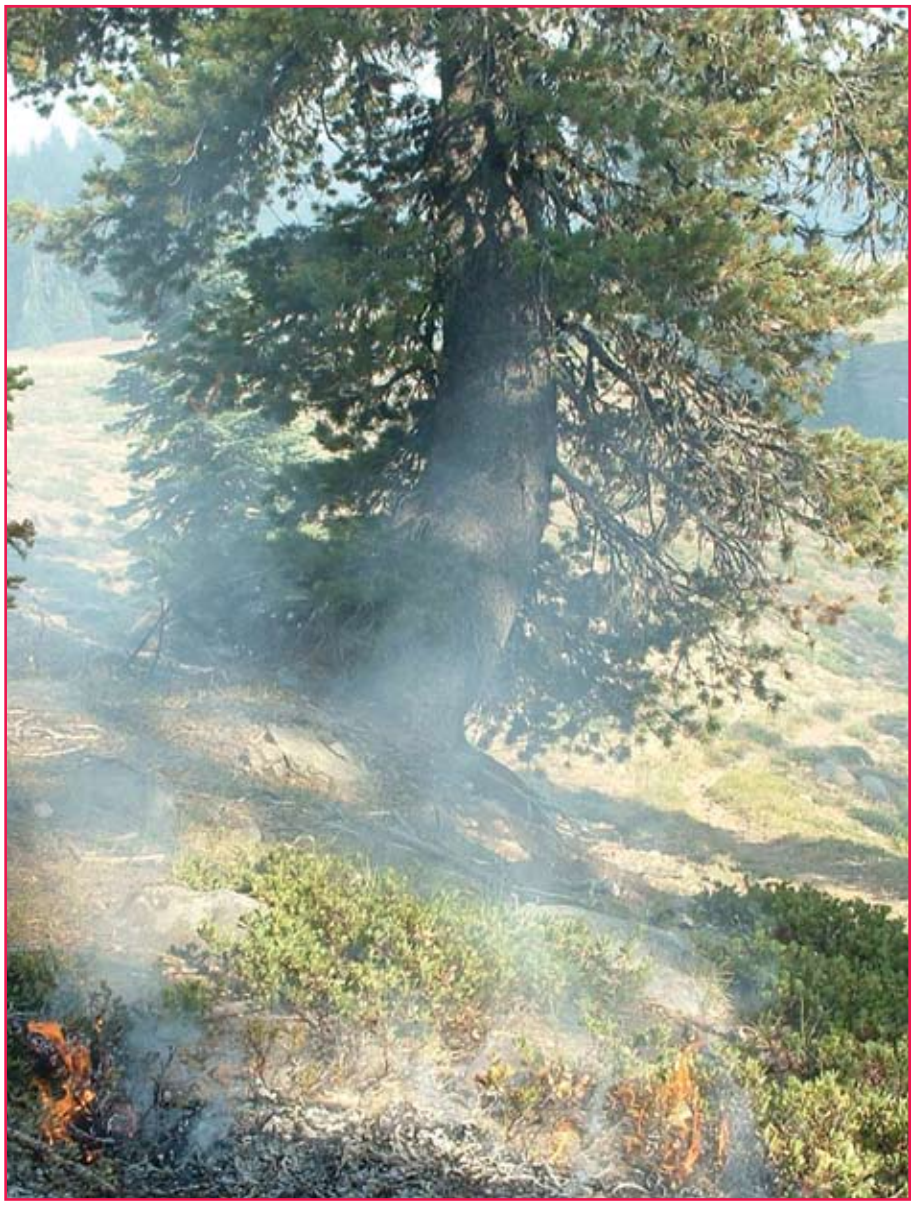
Is Fire Exclusion Affecting Whitebark Pine?

A tree inventory of living and dead individuals with increment core sampling enabled us to track and analyze historical changes in growth and abundance of all species. Since the earliest year of our analysis, it appears that tree volume has increased markedly.

Overall, late-seral species (fir and mountain hemlock) have taken over 12.5 percent of stands. Therefore, although fire exclusion has not led to the reduction of whitebark pine, it is allowing competing species to dominate where whitebark pine once presided. The same trend is true in the Rocky Mountains where subalpine fir is actually reducing whitebark pine through competition (Keane and Arno 1993).

Reintroducing Fire

Since fire has clearly been an important historic component in these forests, this study provides the guidance to reintroduce this missing element.



Reintroducing lightning-ignited fire to whitebark pine ecosystems may maintain this important timberline tree. The Bybee Complex Fire of 2006 (pictured) was a successful application of lightning-fire at Crater Lake National Park's whitebark pine zone. Photo: Courtesy of the USDI National Park Service.

Regime characteristics (frequency and severity) revealed by this study provide guidance for managers to match site-specific regimes for reasonable prescription. However, given the inherent high variability, local resource specialists and ecologists should be used to fine tune prescriptions.

Evaluating fire history and fuel conditions of individual stands prior to any management-ignited burning is critical for these sensitive forests. Specialists should assess stands for visual clues indicating frequent fire including extensive grass or shrub cover and fire scars. Pure whitebark pine forests with sparse living and dead fuels should receive lower priority for prescribed fire.

Recommendations for Managing Cascadian Whitebark Pine with Fire

- **Promote fire as a natural element of whitebark pine forests.** Knowing that nearly all Cascadian whitebark forests have burned in the past calls for the reintroduction of fire to support ecological integrity, including fuel maintenance.
- **Plan management burns based on site-specific regime.** Not all whitebark pine forests burned the same. Site visits and analysis by fire ecologists will provide interpretation of historic regimes to guide management prescriptions.
- **Prioritize stands with historically frequent nonstand replacing fires.** These stands are most impacted by the modern exclusion of fire. Extensive understory vegetation and fire scars are good indicators.
- **Work with pathologists to protect disease-resistant trees.** Retaining naturally resistant trees provides a lifelink to the pine's future. Trained forest technicians can identify such candidate trees prior to burning operations or during lightning-fires (safety permitting). Managers can provide protection from flames by mitigating ladder and surface fuels in the immediate vicinity of selected trees.
- **Support lightning-ignited fires.** Because whitebark pine tends to be in remote wildernesses and parks, and often in areas of discontinuous fuels, immediate threats to human developments are rare. Lightning-ignited fires are beneficial from a cost savings (dollar per area) perspective while providing multiple ecological benefits. When carefully managed, these fires are preferred over prescribed burns, which tend to be more impacting through associated manipulative actions (e.g. control lines, tree felling, etc.).

Of 101 fire events detected, we dated 57 percent directly from fire scars, often supported by the surrounding stand age reconstruction.

Special Acknowledgements—*Joel Siderius, Pacific Northwest Cooperative Ecosystem Studies Unit, Seattle, WA, conducted most of the fieldwork of this project. Thanks also to the staff of Mount Rainier, North Cascades, and Crater Lake National Parks. Staffs of the Olympic National Forest and Wenatchee Forest Sciences Laboratory, as well as the Naches, Leavenworth, Entiat, Chelan, and Methow Valley Forest Service Ranger Districts, provided further assistance.*

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Forest Service Receives 2006 Batefuegos de Oro Award

In November 2006, Spain honored the Forest Service with the Batefuegos de Oro Award—or *golden fire swatter*—for excellence in international technical cooperation. Batefuego is Spanish for fire swatter, the hand tool used by firefighters throughout the world to suppress fires in grasses and other light fuels.

The award was first presented in 2002 by the Asociacion para la Promocion de Actividades Socioculturales (APAS), with the support of Spanish fire managers and stakeholders who established the award to acknowledge firefighting agencies worldwide. Members of the award committee are professionally recognized and respected as firefighting technicians in Spain.

To commemorate the annual event, the APAS committee commissioned a Spanish artist to create a symbolic golden statue of a firefighter wielding a fire swatter tool.

The APAS Committee presented the Forest Service with the statue in recognition of the agency's support of fire-related training and technical exchanges worldwide. The committee also acknowledged the Forest Service's effort to provide Spanish translation, where possible, and to adapt training material to meet local needs and situations.

Chief Gail Kimbell and Deputy Chief Jim Hubbard with the 2006 Annual Batefuegos de Oro awarded to the Forest Service for excellence in international technical cooperation.

Previous winners in the international category include Professor Domingos Viegas from the University of Coimbra, Portugal, for his fire research; the fire agencies in New South Wales, Australia, for their efforts during the 2002 fire season; the Chilean National Forestry Agency for its fire management program; and the Forest Owners Association of Southwestern France for cooperative fuel management activities. ■

Batefuego is Spanish for fire swatter, the hand tool used by firefighters throughout the world to suppress fires in grasses and other light fuels.

The 2006 award categories and winners are:

- International: Forest Service, United States
- Prevention: Spain's National Center for Environmental Education
- Firefighting: The team coordinating national and international response to the fires in Galicia, Spain, in August 2006
- Fire Interpretation and Communication: Agency for Environmental Conservation for the Community of Murcia, Spain
- Education: Eduardo Garcia Solis, a high school teacher in Spain
- Technological Advances: Bombardier, Inc., Canada

Denny Truesdale, Assistant to the Deputy Chief, State and Private Forestry, Forest Service Headquarters, Washington, DC.

Smokey Bear True Confessions

Cindy Frantsen

I could hear their shouts. The crowd was calling my name. Even though I had limited vision of these throngs of people lining the streets, I could hear their excitement. It was contagious.

Any fears I had about making this appearance immediately disappeared. I stopped thinking about how hot I was on this warm, winter day in Phoenix, AZ. My only focus was responding to these thousands of people waving and blowing kisses at me.

I felt dizzy with adoration.

As we traveled the 2-mile Fiesta Bowl Parade route, my arms started to ache as I waved and blew kisses in return. This overwhelming acknowledgement and affection for me—for who I represented—*never* wavered.

The people could not stop shouting my name. And I couldn't stop smiling.

Thousands of Friends

As Smokey Bear in the 36th annual Fiesta Bowl Parade, I literally had thousands of "best" friends—young and old alike.

To say that Smokey is popular is an understatement. In fact, he is so well-known that he has his own ZIP Code (20252). Our legendary bear is the sponsor of the longest-running public-service campaign in U.S. history. And even though he's been around since 1944, his appearances still bring smiles—and shouts—of recognition from generations of people.

Any fears I had about making this appearance immediately disappeared.

Just a few quick hours prior to the parade—before I was in costume—my young "helper," Tyler, was reluctant to talk with me. He was a somewhat shy 10-year-old boy, kind and polite—but he simply had little to say.

That is, until I became **Smokey Bear**.

Once in full Smokey attire, Tyler was suddenly my best friend, standing close beside me, giving me slaps on the back, and repeating high-fives. The transformation was immediate and profound. That's when I truly realized the essence of Smokey Bear.

Why So Admired?

So, just what makes Smokey so popular and so firmly entrenched in our American tradition?

I've always remembered the story of the badly burned little black bear clinging to a tree and rescued by firefighters, but I was not familiar with the rest of the story. After Gary Roberts, our Payson Ranger District's fire prevention officer, convinced me to portray Smokey, I wanted to know more about him (see sidebar).

The Payson Ranger District has been an honorary participant in the Fiesta Bowl Parade the past 4 years. Wildland firefighters from other Tonto National Forest districts, as well as firefighters from

What makes Smokey Bear so popular and so firmly entrenched in our American tradition?

Hotshot crew members and engine crews escort the ever-popular bear at the Fiesta Bowl Parade in Phoenix, AZ. Photo: Tonto National Forest.

When she's not Smokey Bear, Cindy Frantsen is the secretary to the regional administrator of the National Archives in Kansas City, MO.

rural fire departments throughout the Mogollon Rim country, are also recruited.

Emotional Transformation

Knowing that the temperature in Phoenix would be warmish, and that the weight and density of the Smokey outfit—particularly the head—would also make me uncomfortably warm, I dressed appropriately.

I wore shorts, a tank top, and thin socks. I put my hair in a ponytail and wrapped a cold, water-soaked bandana around my neck. I drank plenty of water. But what I was not prepared for was the emotional transformation of actually becoming Smokey.

It was almost overwhelming to feel so well loved. As we moved down that parade route with the people yelling "my" name, I remembered something that Gary Roberts had said: *"Cindy, you'll love it. Playing Smokey is like being a rock star."*

And I did love it. After thriving on this tidal wave of positive attention, I was actually reticent to remove the costume and, once again, become myself. As "plain old me," I knew I wouldn't be nearly as popular.

This experience—the epitome of being Smokey Bear—can be best expressed by the extraordinary transformation that I witnessed in young Tyler. Smokey is ageless and his mere presence has a way of transcending the generation gap.

Gary Roberts was wrong. Being Smokey Bear is *better* than being a rock star. ■

Smokey Bear Helps War Effort

The birth of Smokey Bear goes back to World War II when the Forest Service began promoting fire prevention. Our Government's officials knew that timber was important to this country's war effort. To encourage the general public to help prevent wildland fire, the Forest Service, therefore, formed the Cooperative Forest Fire Prevention Program (CFFP).

The CFFP managers contacted the Wartime Advertising Council to help devise an effective advertising campaign. In 1944, after Walt Disney's popular little fawn character "Bambi" appeared on prevention posters, the decision was made to recruit a bear to represent fire prevention. The rest is history.

The bear was named after "Smokey" Joe Martin, assistant chief of the New York City Fire Department from 1919 to 1930. Radio newscaster Jackson Weaver provided the bear's voice. With the slogan *"Only you can prevent forest fires,"* Smokey reminded millions—again and again—to be careful with fire.

> I was not prepared for the emotional transformation of actually becoming Smokey Bear.

Fuels Management Bibliography: An Erratum

M.E. Alexander

The winter 2007 issue of *Fire Management Today* included a subject indexed fuels management bibliography of previously published articles in *Fire Control Notes* and its predecessors dating back nearly 70 years (Alexander 2007).

It has recently come to my attention that a notable entry was missing from the bibliography. The article by Bower (1963) should have been included with the other eight entries on firebreaks and fuelbreaks.

Dr. Marty Alexander is a senior fire behavior research officer with the Canadian Forest Service, Northern Forestry Centre; and an adjunct professor of wildland fire science and management in the Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada.

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American Indian Fire Use: Policy Implications of the Debate

Hutch Brown

About a century ago, the Forest Service began one of its first major policy debates: whether fire should be used to manage forests, a practice known as "light burning" (Carle 2002). By 1920, the debate was all but decided when William B. Greeley, who would soon become Forest Service Chief, blasted "the fallacy of light burning" as "Paiute forestry" (Greeley 1920).

Shifting Debate

The term "Paiute forestry" was particularly telling. In the early 20th century, the debate was not about *whether* American Indians used fire to manage landscapes, but *that* they did so much of it—which, in the view of early conservationists, violated the precepts of sound, scientific forestry. Had Indians not been stopped from burning, one forester declared, then Virginia's rich forests would have been entirely reduced to grasslands (Maxwell 1910), anathema to a generation weaned on the cut-and-run logging that had devastated so many forested landscapes throughout the East.

Early foresters won the debate, but their success over time was mixed (Langston 1995; Pyne 1982). Particularly troublesome was the policy of fire exclusion, which helped alter ecosystems historically dependent on fire in ways that were neither anticipated nor desired. In the West, several concomitant factors also played a role:

- Heavy livestock grazing eliminated the grasses that carried frequent understory fires,
- High-grading altered forest structure and composition,
- Pulses of wet weather stimulated forest growth in normally arid or semiarid regions, and
- Climate change contributed to fuel volatility (Westerling and others 2006).

> In the early 20th century, the debate was not about *whether* Indians used fire to manage landscapes, but *that* they did so much of it.

Collectively, these influences variously affected landscapes. In areas historically dominated by parklike stands of large long-needle pines, dense carpets of small trees sprang up. In a drought, the overcrowded stands became susceptible to huge fires that were out of character for the original fire-adapted woodlands. Many of these lands are now at high to moderate risk of fires that could compromise human safety and ecosystem integrity (Arno and Allison-Bunnell 2002; Arno and Fiedler 2005; Covington 2002; Schmidt and others 2002).

By the late 20th century, the growing fire severity was setting off alarms. In search of alternative approaches, people began taking a fresh look at how Indians interacted with the land (see, for example, Day 1953; Pyne 1982, 2001; Russell 1983, 1997). Today, few people accuse Indians of mismanagement; instead, the question is whether Indians managed much at all.

Underlying the dispute are alternative policy implications for managing Federal land. Ironically, the degree to which Indians actively shaped the landscapes where they lived has been used to support the case for both preservation and development.

The Case for Preservation

In its simplest form, preservationism conforms to the Romantic view of American Indians typified by Henry Wadsworth Longfellow's The *Song of Hiawatha* (1855) (for a brief discussion of the Romantic view of nature, see Brown 1999).

In the Romantic view, Indians lived in a "state of nature," in harmony with their environment, doing little to alter landscapes beyond the slash-and-burn agriculture practiced by some tribes around their small riparian villages. Influenced by the Romantic view, Federal land managers have traditionally pursued a policy of maintaining national parks, wilderness areas, and many older forests in a "natural condition" unaffected by human activities (Delcourt and Delcourt 2004).

Preservationists draw on the view of Indians living in harmony with nature to argue against active

Hutch Brown is a policy analyst for the Forest Service, Washington, DC.

management altogether. "Tens of millions of North America's indigenous people lived in peace with wildland fire for thousands of years," declares one Forest Service critic (Stahl 2004), implying that Indians did not actively manage landscapes. In the Midwest, preservationists seized upon a poorly researched paper about presettlement Indian activities (McCorvie 1994) to oppose active management on national forest land (Day 2005). In response, the Forest Service's ecologist for the Eastern Region drafted a detailed rebuttal (Nowacki 2002).

Some of the fiercest debate has centered on the idea of wilderness as "untrammeled by man," a notion challenged by J. Baird Callicott, who points out that Indians shaped many of the wilderness landscapes they lived in, particularly through fire use (Callicott 1995; Callicott and Nelson 1998).

Holmes Rolston defends the wilderness idea by denying that Indians modified the rugged, higher elevation landscapes in most of today's wilderness areas (Callicott and Nelson 1998). Noss (1995) attempts to resolve the debate by broadening the notion of wilderness, drawing a distinction between the way wilderness landscapes evolved—in some places under the influence of Indian fire use—and the kinds of postsettlement human impacts that inevitably destroy wilderness.

The Case for Development

Some reject such distinctions as arbitrary, challenging the very notion that postsettlement activities in any way degraded, damaged, or destroyed ecosystems. Citing Callicott (1995), Diamond (1987), and Lackey (2001), Davis and Slobodkin (2004) question the whole concept of ecosystem health, suggesting that it signifies value-based social preferences rather than a scientifically determinable condition of the land. They support ecosystem restoration, but as a social choice rather than as an effort to return to presettlement conditions.

Today, few people accuse Indians of mismanagement; instead, the question has become whether Indians managed much at all.

Fitzsimmons (1999) goes a step further, arguing that ecosystems are constructs that do not exist at all. He sets up a straw man that he can easily knock down, arguing that ecosystems are living beings in static equilibrium and that it takes a leap of faith to believe in them. By contrast, forests are dynamic and subject to constant change, so there is nothing systemic in nature that needs protection—or restoration—from degradation or damage. All that matters are the values and uses associated with natural resources, which change over time according to shifting human needs. If development best serves those needs, then nothing should stand in its way.

The American Indian experience can be seen to support the case for development in that Indians altered landscapes, tailoring them to their needs (Fitzsimmons 1999). In a sense, Indians were the first land developers. Delcourt and Delcourt (2004) attribute the Pleistocene megafaunal extinctions, which profoundly altered vegetative structures (Pyne 2001), in part to overhunting by people using Clovis spearheads.

Tribal peoples simply met their own particular resource needs, heedless of the ecological impacts, just as European settlers later met theirs, though less extensively and intrusively. In the view of some, this is precisely what people should be doing today in managing Federal lands: They should be shaping

Did American Indians Cause Ecological Degradation?

Long before European settlement, agriculture by American Indians gave rise to relatively large populations with flourishing cultures in the valleys of the central Mississippi River and its tributaries. According to Delcourt and Delcourt (2004), tribal peoples supplemented their diets with nuts, actively managing forests to promote masts. Their cultural activities converted natural late-successional forests into "an early-successional, anthropogenically managed mosaic of [oak–hickory–walnut] forests and [agricultural] old-fields." However, their populations finally reached unsustainable levels "as native forest ecosystems became fragmented beyond the connectivity threshold," resulting in "evacuation of the Mississippian heartland a little more than 500 years ago" (Delcourt and Delcourt 2004).

and developing public lands in accordance with their own values and needs, best expressed through modern market mechanisms (Fitzsimmons 1999).

Moot Points

Whereas preservationists insist that Indians—unlike people today—lived in harmony with nature, Fitzsimmons (1999) takes the opposite view, maintaining that tribal people had to struggle with nature for a living and therefore altered landscapes wherever they went, just as people do today.

The reality is more complex. Human impacts on landscapes in presettlement times were on a continuum of "concentric circles radiating outward" (Delcourt and Delcourt 2004; Johnson and Earle 2000), ranging from high in areas used for living, farming, and gathering (see sidebar on page 34); to moderate in travel corridors and outlying areas used for hunting; to minimal in remote areas where people seldom went. For example:

- Tribes routinely burned small portions of the Pacific Northwest to stimulate huckleberry growth (French 1999; Mack 2003). However, such huckleberry "yards" and the "corridors" needed to reach the yards (Lewis 1988) were surrounded by vast expanses of ancient rainforest that showed little or no human influence.
- Indians frequently set fires to maintain open forests around Seeley Lake, MT (Arno and Fieldler 2005; Brown 2005), but such corridors in the Northern Rockies often led through tangles of boreal forest that rarely burned (Barrett 2004; Barrett and others 2005). American explorers Lewis and Clark (Ambrose 1996; DeVoto 1981) and Canadian explorer David Thompson (Jenish 2003), while crossing the Northern Rockies to the Pacific Ocean, found parts of them so wild and inhospitable that they almost starved.
- At the time of European settlement, the vegetation in much of the Eastern United States—particularly in the more southerly ecological divisions characterized by Bailey (1980) as hot continental and subtropical—was on a fire-governed continuum ranging from tallgrass prairie (with very frequent fire); to oak and pine savannas (with frequent fire); to closed oak–pine, oak–hickory, and oak–chestnut forests (with occasional fire) (Bonnicksen 2000; Delcourt and Delcourt 2004; Stewart 2002; Whitney 1994). In much of the East, dry lightning is rare, yet fire was relatively frequent, suggesting human origins. In Virginia, for example, Indians used fire to open and maintain large grassy areas for bison and elk, including the entire Shenandoah Valley and parts of the Piedmont to the east (Brown 2000; Stewart 2002). Still, such openings were set in a forested matrix that included mesophytic forest types that would have seldom burned, particularly in wetlands and mountain coves, on floodplains, and in topographically protected areas.

Pine savanna on Wade Plantation in Thomas County, GA. The fire-maintained ecosystem, typical of presettlement landscapes across millions of acres on the southern coastal plain, supports wiregrass and widely spaced longleaf and slash pines. Photo: David J. Moorhead, University of Georgia (courtesy of Forest Images <http://www.forestimages.org>).

> Many—but not all—presettlement landscapes were frequently disturbed, and many disturbance-adapted ecosystems can be restored.

In part, the debate has been fueled by differences in academic focus (Delcourt and Delcourt 2004): Archeologists and economists study human activities with high environmental impacts, whereas ecologists and paleoecologists focus more on natural processes in remote areas. Delcourt and Delcourt (2004) outline a new interdisciplinary

approach to explain "human ecosystems as self-organized, complex adaptive systems" within the larger "adaptive cycles of organization, disruption, and reorganization of ecoystems" in Holocene North America.

For many, however, the debate remains a pointless argument by proxy: Each side plays on public biases about Indians to promote its own vision for the future of Federal lands. The real point is that many—but not all—presettlement landscapes were frequently disturbed. Whether the cause was human or natural is immaterial for land management purposes (Arno and Fiedler 2005). Whatever the cause, researchers can often piece together enough evidence of a disturbance history to allow land managers to restore a reasonable semblance of presettlement compositions, structures, and functions for disturbance-adapted ecosystems (Engstrom and others 1999).

The Case for Restoration

The prospect of ecological restoration begs a question: Is the past at all relevant for land management today? Or should land managers be guided by modern values and needs alone?

The international community has come to accept the need for balancing the social, economic, and ecological components of sustainable land management (Forest Service 2004). Although striking the right balance is difficult, it does require accounting for ecological considerations—the compositions, structures, and functions that characterize communities of plants and animals. These complex sets of ecological interactions have come to be known as ecosystems (Tansley 1935).

Ecosystems are indeed constructs, but that makes them no less real. Forests are also constructs, as are communities and market economies; their delineation and workings are subject to considerable debate,* yet no one would argue that these things do not exist. Ecosystems constitute interdependencies that the organisms in them need to survive—whether as individuals, species, or lifeforms—and they are not static, but subject to ongoing adaptive transformations (Delcourt and Delcourt 2004; O'Neill 2001). As the species in ecosytems evolve in response to new stimuli in their environments, ecosystems correspondingly evolve.

* Gifford Pinchot, in addressing the Saturday Club in Boston, MA, on November 30, 1895, tried in vain to describe what a forest is, only to conclude that "I have been unable to find or prepare an entirely satisfactory definition."

However, if change comes too fast, as often happens through land use conversion, ecosystems can be degraded, damaged, or destroyed. For example, a trout stream—a particular kind of aquatic ecosystem—will collapse if too much of the watershed is converted to impervious surfaces; most of the organisms in it will die and most of the species will disappear. The stream will become a biologically impoverished conduit for stormwater runoff.

The past is therefore relevant for land managers in two ways:

1. *As opportunity.* By emulating the disturbance regimes that governed historical species assemblages and regulated

Ponderosa pine forest with encroaching grand fir understory on the Malheur National Forest in northeastern Oregon. Even where overgrown and degraded, ponderosa pine forests offer reference conditions for restoration resembling the original ecosystem. Old trees, logs, and stumps provide evidence of historical stand composition and structure; fire scars reflect historical fire return intervals. Photo: Dave Powell, Forest Service (courtesy of Forest Images <http://www.forestimages.org>).

historical communities, a semblance of the original ecosystem can often be restored, even taking climate change into account (see the sidebar). Where restoration is possible, people can choose to embrace or reject it based on their values and needs. For example, they might choose to restore a ponderosa pine ecosystem to satisfy heritage values, to abide by a land ethic, or to meet concomitant needs for improved waterflows, enhanced biodiversity, and reduced fire danger. The process for making such collaborative decisions on national forest land is the land and resource management planning called for under the National Forest Management Act of 1976.

2. *As guide.* If the choice is made for restoration, then land managers need guidance on how to achieve it. In particular, they need a reference ecosystem—"a model used to plan an ecological restoration project and later to serve in the evaluation of that project" (Day and others 2005). The model is based on evidence from the past of the composition, structure, and functions that characterized the ecosystem to be restored. For example, in restoring ponderosa pine, land managers might base the treatment prescription partly on residual evidence on the ground—old logs, stumps, and depressions indicating the number and distribution of trees in the original forest (ERI 2005).

Where ecosystem restoration is possible, people either embrace or reject it based on their values and needs.

Climate Change and Ecological Restoration

Climate sculpts ecosystems (Millar 2004). Climate change can reach a point where it alters patterns of vegetation across a landscape. Research in the Sierra Nevada, for example, suggests that forest encroachment on high-elevation meadows is due to a warming climate (Millar and others 2004), dooming any efforts to restore such meadows. In an age of climate change, land managers are preparing to adapt the ecosystems they manage to changing climatic conditions.

However, even under a changing climate, not all landscapes are certain to assume entirely new characteristics. Outside of Alaska, signs of ecological transition in the United States are (so far) relatively rare. Forest treatments such as thinning and underburning restore an ecosystem's resistance to drought, insects, disease, and fire; they also restore its resilience following a wildfire or other major disturbance. Climate change exacerbates such stresses and disturbances; land managers can therefore use restoration, where appropriate, as a way to mitigate the worst effects of climate change.

A national survey in 1999–2000 suggested strong public support for restoring ecosystems on national forest land to something resembling their presettlement conditions (Shields and others 2002). People attach values such as "naturalness" and wildland heritage to the national forests and grasslands that they do not to the towns where they live or to the farms that grow their food. In a neighborhood greenway corridor, for example, residents might accept a largely lifeless conduit for stormwater runoff; but on national forest land, they generally prefer a trout stream.

Federal Policy

Since the 1990s, Federal land managers have articulated a strong policy focus on ecological restoration, particularly for fire-adapted ecosystems:

- The interagency wildland fire policy of 1995, updated in 2001, emphasizes "the need for restoration and rehabilitation of fire-damaged lands and ecosystems," partly by restoring "the role of fire in ensuring ecosystem sustainability" (IFWFPRWG 2001).
- The National Fire Plan of 2000 makes ecological restoration one of five goals; its purpose is to "restore damaged landscapes" through "thinning and the restoration of fire" (NFP 2000).
- The 10-year plan for implementing the 2001 interagency strategy for reducing fire risk, updated in 2005, promotes "restoration of fire-adapted ecosystems" (10-Year Plan 2002).

For years, the Forest Service has pursued various forms of ecological restoration, from restoring degraded salmon and trout streams, to restoring remnants of tallgrass prairie, to restoring overgrown

long-needle pine ecosystems and degraded oak savannas and woodlands. In fact, the Forest Service's main focus, according to former Chief Dale Bosworth (2004, 2005), has shifted from resource extraction in the decades following World War II to ecological restoration and outdoor recreation today. Nevertheless, the Forest Service had no well-defined restoration policy—or even a common definition until recently. In 2005, the Forest Service's Executive Leadership Team commissioned a group to propose a framework for ecological restoration on national forest land (Day and others 2005). The agency is in the process of implementing its new Restoration Framework.

Transcending the Debate

As the debate about "Paiute forestry" indicates, Americans have long used ancestral practices by American Indians to promote particular land management policies. In recent years, some have used the Romantic view of the noble savage to campaign against active management; whereas others, having discovered "that Native Americans were not the fine ecological stewards we imagine" (Kristof 2005), suggest that focusing on resource extraction is only natural. In effect, Indians are pressed into service to support competing visions for the future of Federal lands: preservation versus development.

Ecological restoration transcends the debate. What matters is not whether Indians altered presettlement landscapes, but that presettlement disturbance regimes—whatever their cause—shaped many ecosystems for thousands of years. Researchers can often reconstruct what happened, providing a choice: Based on site-specific information, people can choose to restore a semblance of presettlement ecosystems on Federal land. For more information on the integration of ecological restoration into Forest Service policy, contact Greg Kujawa, Forest Service, Yates Building, 201 14th Street, SW, Washington, DC 20024, 202-205-1762 (tel.), gkuzawa@fs.fed.us (e-mail).

Since the 1990s, Federal land managers have articulated a strong policy focus on ecological restoration, particularly for fire-adapted ecosystems.

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Proceedings of the Wildland Fire Safety Summits

Martin E. Alexander and Bret W. Butler*

The International Association of Wildland Fire (IAWF) is a non-profit, professional association representing members of the global wildland fire community. The purpose of the association is to facilitate communication and leadership for the wildland fire community.

Since 1997, the IAWF has hosted nine Wildland Fire Safety Summits at various locations in the United States, Canada, and overseas. These summits bring together wildland firefighting professionals and others from around the world. Through presentations, displays, and group breakout sessions, participants exchange information on fireline safety, risk management, cultural changes, and wildland fire research.

In preparing the proceedings for the 2005 Eighth Wildland Fire Safety Summit, we made a concerted effort to consolidate the proceedings from the previous summits in a single CD disk. The intent of consolidating these records was to establish "an institutional memory for the IAWF and in turn the entire global wildland fire community" (Butler and Alexander 2005).

In 2005, the International Association of Wildland Fire began publishing the collective proceedings of all their Wildland Fire Safety Summits onto a single CD disk.

The CD of the proceedings for the Ninth Wildland Fire Safety Summit held in 2006 has maintained that concept established in 2005, where as each successive safety summit takes place, the previous proceedings will be included with the current one, resulting in a very valuable wildland fire safety resource.

The proceedings of all nine Wildland Fire Safety Summits are available on a single CD disk for a nominal charge. Alternatively, they can be downloaded from the IAWF Web site free of charge. For more information about the IAWF and their safety summits, consult their Web site at <http://www.iawfonline.org>.

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Butler, B.W.; Alexander, M.E. 2005. Foreword: Why "human factors ten years later"? In: Butler, B.W.; Alexander, M.E., eds. Proceedings of eighth wildland fire safety summit. Hot Springs, SD: International Association of Wildland Fire. CD-ROM: 1-6. ■

Past IAWF Wildland Fire Safety Summit Locations and Dates

- Rossland, British Columbia, Canada, September 29-October 2, 1997
- Winthrop, Washington, USA, October 26-29, 1998
- Sydney, New South Wales, Australia, November 2-5, 1999
- Edmonton, Alberta, Canada, October 8-10, 2000
- Missoula, Montana, USA, November 6-8, 2001
- Luso, Portugal, November 18-23, 2002
- Toronto, Ontario, Canada, November 18-20, 2003
- Missoula, Montana, USA, April 26-28, 2005
- Pasadena, California, USA, April 25-27, 2006

*Marty Alexander received the 2003 IAWF International Wildland Fire Safety Award, given to a member of the wildland fire community who has made a significant contribution to wildland firefighter safety, either directly on the fireline or indirectly through management, research, or cultural changes. Bret Butler has served as a proceedings coeditor for three IAWF Wildland Fire Safety Summits (i.e., 2000, 2001, and 2005).

Dr. Marty Alexander is a senior fire behavior research officer with the Canadian Forest Service, Northern Forestry Centre, and an adjunct professor of wildland fire science and management in the Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada. Dr. Bret Butler is a research mechanical engineer with the Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT.

Wildland Fire Safety Featured in Wilderness Medicine Book[1]

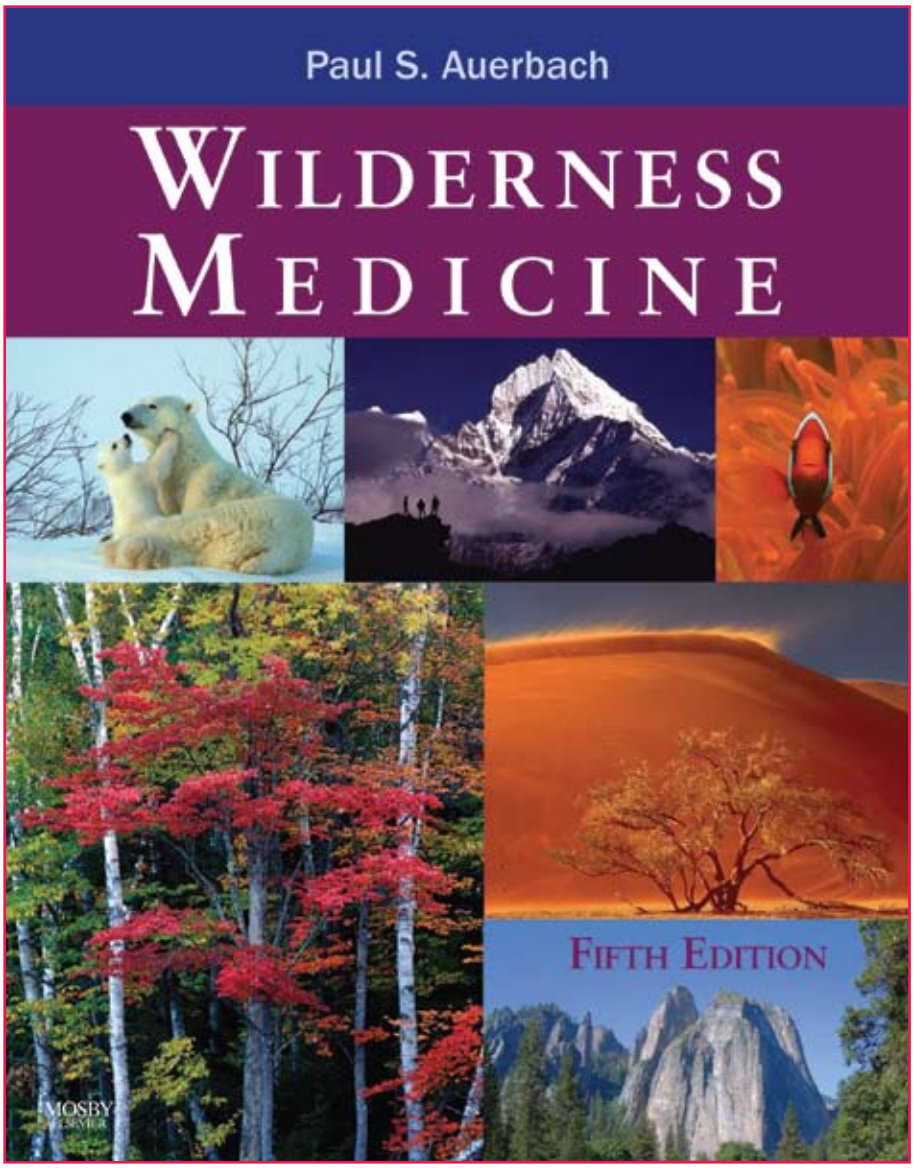
Martin E. Alexander

Wilderness medicine is the practice of providing medical attention when definitive care is further than 1 hour's travel time to provide medical treatment. In very remote locations, it can take days or weeks for rescuers to reach victims.

The practice of wilderness medicine comes into practice when it's necessary to seek medical attention for an injured or ill patient and, because of their location, rescue efforts are hindered or limited by access, terrain, available equipment, and extreme environments.

To help provide guidance in these situations, the C.V. Mosby Company published the fifth edition of Wilderness Medicine last year with Dr. Paul S. Auerbach as editor.

Dr. Auerbach is a practicing physician serving as the Clinical Professor of Surgery in the Division of Emergency Medicine at the Stanford University Medical Center, California, and a founder and past president of the Wilderness Medicine Society.



Wilderness Medicine, first published in 1983 under the title Management of Wilderness and Environment Emergencies, has grown expansively. This fifth edition consists of 97 chapters with a variety of topics, such as lightning injuries, emergency care of the burned victim, heat-related illnesses, injury prevention, and essentials of wilderness survival.

Since the first edition of Wilderness Medicine, a section has been dedicated to wildland fire, with Kathy Davis, National Park Service, and

[1] Based on poster paper presented at the 4th International Wildland Fire Conference, 13-17 May 2007, Seville, Spain (Alexander 2007).

Dr. Marty Alexander is a senior fire behavior research officer with the Canadian Forest Service, Northern Forestry Centre, and an adjunct professor of wildland fire science and management in the Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada.

Bob Mutch, Forest Service retired, participating as authors (Davis and Mutch 1987).

In the fifth edition, I was asked to serve as the lead author of the wildland fire chapter (Alexander and others 2007).

The wildland fire section familiarizes the reader with wildland fire terminology, equipment, resources, and emergency management strategies and policies. It takes a look at fire as a historical force, the nature and scope of wildland fire hazards, fire behavior, typical injuries, fatality fire statistics and incidents, and survival techniques.

While the chapter emphasizes North America, other regions of the globe are referenced, most notably is Australasia.

Readers will find the wildland fire chapter well-illustrated with nearly 40 photographs and diagrams. As a part of this chapter, Wilderness Medicine's accompanying DVD cites more than 400 bibliographic references and the titles of more than 100 additional suggested readings.

Naturally, Wilderness Medicine's primary audience is emergency medical and search and rescue personnel. According to comments and feedback, however, the general public who visit the wilderness would also benefit from the descriptive information as would any "student of fire."

Thanks to the efforts of Paula Nasiatka, Wildland Fire Lessons Learned Center, and Dave Thomas (Forest Service, retired), Wilderness Medicine publishers have agreed to produce offprints of just the wildland fire chapter for distribution within wildland fire community.

For further information about Wilderness Medicine visit: http://www.us.elsevierhealth.com/product.jsp?isbn=9780323032285

Comments on the Book Chapter "Wildland Fires: Dangers and Surival" from Down Under:

"A concise, but impressively comprehensive, account of both wildfire behavior and human behavior in the presence of wildfires. A compelling case is made that even in apparently mild wildfires there is a need for constant vigilance, not only by firefighters, but also by civilians and medical response teams.

I am making your chapter "essential" reading for any student or research staff that joins us to study the role of human factors in firefighter decisionmaking."

A popularized version of the wilderness medicine logo. See <http://www.wilderness-medicine.com/>.

Dr. Mary M. Omodei
Senior Lecturer
School of Psychological Science
La Trobe University
Melbourne, Victoria, Australia

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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.

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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 (on the World Wide Web at <http://www.fs.fed.us/fire/planning/firenote.htm>) for placement of the author's name, title, agency affiliation, and location, as well as for style of paragraph headings and references.

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