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FIRE POLICY UPDATE

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Ann Veneman, Secretary
U.S. Department of Agriculture

Dale Bosworth, Chief
Forest Service

Jerry Williams, Director
Fire and Aviation Management

April J. Baily
General Manager

Robert H. "Hutch" Brown, Ph.D.
Managing Editor

Madelyn Dillon
Editor

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On the Cover:

A hand crew utilizes a rocky area for additional safety and fireline effectiveness. Our first priority, reconfirmed by the 2001 Federal Fire Policy (see the executive summary on page 7), is firefighter and public safety. Photo: Ravi Miro Fry, USDA Forest Service, Boise National Forest, Boise, ID.

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

FIRE 21

Firefighter and public safety is our first priority.

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Policy Initiatives in Wildland Fire Management

Hutch Brown

Fires in recent decades have grown in size and severity on national forest lands. In 1987, for only the first time since 1919, fires burned more than a million acres (400,000 ha) on the National Forest System. More than a million acres burned again in 1988, 1994, and 1996. In 2000, more than 2 million acres (800,000 ha) burned. Suppression costs have climbed accordingly, reaching a record $1.6 billion across all ownerships in 2000 (ACPP 2000).

Severe fire seasons and evolving insights into land and resource management have generated a series of recent initiatives for wildland fire management.

Planning Revisions

The trend toward larger fires and higher costs became clear in 1994, generating a series of reports under the rubric FIRE 21 (see sidebar). New research and insights have generated a second series of reports, linked to the Forest Service's strategic direction for land and resource management planning.

Strategic Direction. The National Forest Management Act of 1976 requires the Forest Service to establish a rule to guide local managers in preparing land and resource management plans for the National Forest System. The first planning rule, adopted in 1982, was due for revision by the 1990s. After more than 10 years of preparation, a new planning rule was proposed in October 1999 and promulgated in December 2000 after extensive public hearings. Based on a March 1999 report by the second Committee of Scientists (COS 1999), the promulgated rule confirms the principle of ecological, social, and economic sustainability.* Land and resource management are to be based on cooperatively developed landscape-level goals following scientific regional assessments.

2001 Federal Fire Policy. The 2000 Cerro Grande Fire,** an escaped prescribed burn that spread to Los Alamos, NM, triggered a review of fire policy. The findings strengthened the 1995 Federal Fire Policy (NWCG 1995), replacing it in January 2001 with a new interagency policy for managing wildland fire (NWCG 2001). The new policy calls for using "the full range of fire management activities … to achieve ecosystem sustainability," including fire use. The policy stresses the need to complete or revise fire management plans that are "more effectively and directly" integrated "with other natural resource goals."

Agency Strategy. In January 2000, the Forest Service released *An Agency Strategy for Fire Management*, a report addressing major long-term issues such as a declining workforce and the growing number of large fires (S&PF 2000). The report recommends restructuring the fire organization, partly for "improved integration of fire into ecosystem management, planning, and decisions."

The Rabbit Creek Fire, part of the Idaho City Complex on Idaho's Boise National Forest in 1994. The fire was enormous, burning 146,400 acres (59,250 ha) in 73 days. Photo: Karen Wattenmaker, USDA Forest Service, Boise National Forest, Boise, ID, 1994.

*Although the new rule was under review as this issue went to print, its implications for fire management are likely to remain about the same.

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

Hutch Brown is the managing editor of Fire Management Today*, USDA Forest Service, Washington Office, Washington, DC.*

Cohesive Strategy. In October 2000, the Forest Service released *Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy* (F&AM 2000a) in response to a report to Congress by the General Accounting Office (GAO 1999). Building on the Agency Strategy, the Cohesive Strategy calls for "sustaining natural resources in short-interval, fire-adapted ecosystems" through adaptive management. The report recommends specific actions for restoring and maintaining fire-adapted ecosystems, including fire use.

National Fire Plan. In September 2000, the Secretaries of Agriculture and the Interior released *Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000* (USDA/USDI 2000). The report and associated materials are known as the National Fire Plan. In fiscal year 2001, Congress funded the National Fire Plan, including $1.1 billion for the Forest Service. The plan is a blueprint for implementing the Agency Strategy based on the 2001 Federal Fire Policy, taking actions recommended in the Cohesive Strategy. The plan calls for:

- Providing sufficient firefighting resources for the future;
- Rebuilding communities and rehabilitating fire-damaged ecosystems;
- Reducing fuels in wildlands at risk from uncharacteristic fire effects, especially near communities;
- Working with local residents to reduce fire risk and improve fire protection; and
- Ensuring accountability.

> The 2001 Federal Fire Policy calls for using "the full range of fire management activities … to achieve ecosystem sustainability."

FIRE 21

FIRE 21 was conceived by the USDA Forest Service to capture the synergy among the reports that emerged following the 1994 fire season.* In that year, 34 firefighters perished, by far the most in any single fire season since 1990. In addition, some 1.4 million acres (570,000 ha) burned on the national forests and grasslands, only the third time since 1919 that more than a million acres had burned on the National Forest System.

FIRE 21 projected a new direction for Forest Service wildland fire management in the 21st century, including these goals:

- Improving firefighter and public safety;
- Restoring, maintaining, and sustaining ecosystem function for healthier forest ecosystems;
- Increasing accountability at all agency levels;
- Enacting a safe and cost-effective Fire and Aviation Management program; and
- Integrating wildland fire management concerns and the role of fire into all agency resource management programs.

The FIRE 21 symbol reflects the Forest Service's ongoing commitment to the safe and prudent use of fire in managing natural resources in the 21st century. It was developed in 1996 by Michael G. Apicello and Rodney C. Kindlund, USDA Forest Service.

The symbol's overall shape represents the fire triangle—the combination of oxygen, fuel, and heat needed to generate fire. The three outer red triangles stand for the basic functions of the Forest Service's fire organization: planning, operations, and aviation. The triangles point inward to the base of the flame, representing the three faces of fire management: prevention, suppression, and prescription.

The black interior symbolizes land affected by fire. The three emerging green tips represent growth, restoration, and sustainability of fire-adapted ecosystems. The flame, the fire within, reminds us that fire is an ever-present force in nature. The FIRE 21 inscription stands for the Forest Service's commitment to the safe and prudent use of fire in all fire management activities.

* See Michael G. Apicello, "FIRE 21—Fire Management in the 21st Century," *Fire Management Notes* 56(3): 4–5.

Large-Fire Costs. A report released in 2000 by the Forest Service's Strategic Overview of Large Fire Costs Team assessed the factors contributing to rising suppression costs and made recommendations (F&AM 2000b).*

Focus on Results

The new initiatives are interconnected in a planning hierarchy for wildland fire management on the National Forest System. The agency's strategic direction outlines objectives for healthy lands and communities through sustainable forest management. Fire management plans are an integral part of local land and resource management planning. The 2001 Federal Fire Policy guides fire managers in applying the new planning rule to fire management plans. The Agency and Cohesive Strategies formulate strategic approaches for integrating wildland fire management into land and resource management planning. This issue of *Fire Management Today* presents summary materials from the 2001 Federal Fire Policy, Agency Strategy, and Cohesive Strategy.

As always, the challenge will be to translate policy directives and strategic initiatives into cost-effective, on-the-ground results. The National Fire Plan outlines programs for working with local communities to improve fire protection and restore ecosystem health. For the executive summary of the National Fire Plan, see *Fire Management Today* 61(2): 9–11.

The new initiatives are interconnected in a planning hierarchy for wildland fire management on the National Forest System.

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Prescribed fire on Montana's Lewis and Clark National Forest. From 1992 to 1998, the number of fuels treatments on the National Forest System, including prescribed fire and thinning, more than quadrupled to about 1.5 million acres (600,000 ha) per year (F&AM 2000). The National Fire Plan calls for even more fuels treatments. Photo: USDA Forest Service, 1991.

* For more on large fire costs, see the related articles in *Fire Management Today* 61(3).

Review and Update of the 1995 Federal Wildland Fire Management Policy (Executive Summary)

Editor's note: On June 27, 2000, following the Cerro Grande Fire (an escaped prescribed burn) near Los Alamos, NM, the Secretaries of Agriculture and the Interior requested a comprehensive review of the interagency wildland fire management policy established in 1995. The review and update were released in January 2001. The executive summary is reprinted here, lightly edited. The full report is posted on the World Wide Web at <http://www.nifc.gov/fire_policy/index.htm>.*

The Interagency Federal Wildland Fire Policy Review Working Group, at the direction of the Secretaries of the Interior and Agriculture, reviewed the 1995 *Federal Wildland Fire Management Policy and Program Review* and its implementation. The Working Group found that the policy is generally sound and continues to provide a solid foundation for wildland fire management activities and for natural resources management activities of the Federal Government.

In this *Review and Update of the 1995 Federal Wildland Fire Management Policy*, the Working Group recommends selected changes and additions to the 1995 Federal Wildland Fire Management Policy to clarify purpose and intent and to address issues not fully covered in 1995.

The Working Group further found that implementation of the 1995 Federal Fire Policy remains incomplete in many areas, especially those that involve collaboration, coordination, and integration across agency jurisdictions and across different disciplines. The Working Group recommends a number of strategic implementation actions to ensure that Federal wildland fire management policy is successfully implemented in all applicable Federal agencies in a collaborative, coordinated, and integrated fashion as quickly as possible.

> The 1995 Federal Fire Policy is generally sound and continues to provide a solid foundation for wildland fire management.

In summary, the Working Group finds and recommends that Federal fire management activities and programs are to provide for firefighter and public safety, protect and enhance land management objectives and human welfare, integrate programs and disciplines, require interagency collaboration, emphasize the natural ecological role of fire, and contribute to ecosystem sustainability.

The 2001 Federal Fire Policy contained in this report replaces the 1995 Federal Fire Policy. It should be adopted by all Federal agencies with fire-management-related programs and activities, as appro-

Water drop on the May 2000 Cerro Grande Fire in Santa Clara Canyon near Los Alamos, NM. The fire, an escaped prescribed burn, triggered a comprehensive Federal fire policy review, resulting in the 2001 Federal Fire Policy. Photo: W.R. Fortini, Jr., USDA Forest Service, Cibola National Forest, Mountainair Ranger District, Mountainair, NM, 2000.

* See Jim Paxon, "'Remember Los Alamos': The Cerro Grande Fire," *Fire Management Today* 60(4): 9–14.

priate, through directives, manuals, handbooks, and other documents.

Subsequent to the initiation of this *Review and Update*, the Secretaries of the Interior and Agriculture prepared a report, *Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000*,* and the Congress provided substantial new appropriations and guidance in the Fiscal Year 2001 Interior and Related Agencies Appropriations Act. The activities resulting from the Secretaries' report and the congressional action are generally known as the National Fire Plan. Although this *Review and Update* supports and complements the National Fire Plan, the two efforts are different. This *Review and Update*, with its findings and recommendations, provides a broad philosophical and policy foundation for Federal agency fire management programs and activities, including those conducted under the National Fire Plan. In contrast, the National Fire Plan and similar interagency activities focus on operational and implementation activities. A major feature of the National Fire Plan is the interagency (especially between Federal and non-Federal entities) aspect of risk reduction planning and implementation. In summary, the 2001 Federal Fire Policy contained in this report is focused on internal Federal agency strategic direction for a broad range of fire-management-related activities, whereas the National Fire Plan is a more narrowly focused and tactical undertaking involving both Federal and non-Federal entities.

* For the executive summary of the report to the President associated with the National Fire Plan, see *Fire Management Today* 61(2): 9–11.

As a result of fire exclusion, the condition of fire-adapted ecosystems continues to deteriorate.

Background

The 1995 *Federal Wildland Fire Management Policy and Program Review* produced the first single comprehensive Federal fire policy for the Departments of the Interior and Agriculture. That review was stimulated by the 1994 fire season, with its 34 fatalities, and growing recognition of fire problems caused by fuel accumulation. The resulting 1995 Federal Fire Policy recognized, for the first time, the essential role of fire in maintaining natural systems.

In the aftermath of the escape of the Cerro Grande Prescribed Fire in May 2000, the Secretaries of the Interior and Agriculture requested a review of the 1995 Federal Fire Policy and its implementation. They directed the Working Group to:

- Review the implementation status of the 1995 Federal Fire Policy.
- Address specific issues related to interagency coordination, cooperation, availability, and use of contingency resources.
- Provide recommendations to the Secretaries for strengthening the organizational structure of wildland fire management programs to ensure effective implementation of a cohesive Federal wildland fire policy.
- Provide any other recommendations that would improve Federal wildland fire management programs.
- Recommend a management structure for completing implementation of the recommendations.

The Cerro Grande Fire approaching an incident command post. Thousands were safely evacuated from in and around Los Alamos, NM; no injuries resulted from the fire. Under the 2001 Federal Fire Policy, firefighter and public safety remains our first priority. Photo: W.R. Fortini, Jr., USDA Forest Service, Cibola National Forest, Mountainair Ranger District, Mountainair, NM, 2000.

All Federal fire program activities should take place in cooperation and partnership with State and other organizations.

Principal Conclusions

The Working Group reached the following principal conclusions:

- The 1995 Federal Fire Policy is still generally sound and appropriate.
- As a result of fire exclusion, the condition of fire-adapted ecosystems continues to deteriorate; the fire hazard situation in these areas is worse than previously understood.
- The fire hazard situation in the wildland–urban interface is more complex and extensive than understood in 1995.
- Changes and additions to the 1995 Federal Fire Policy are needed to address important issues of ecosystem sustainability, science, education, and communication; and to provide for adequate program evaluation.
- Implementation of the 1995 Federal Fire Policy has been incomplete, particularly in the quality of planning and in interagency and interdisciplinary matters.
- Emphasis on program management, implementation, oversight, leadership, and evaluation at senior levels of all Federal agencies is critical for successful implementation of the 2001 Federal Fire Policy.

Implementation

Each of the departments or agencies participating in the review should adopt the guiding principles, 2001 Federal Fire Policy statements, and implementation actions in this *Review and Update*. All Federal fire program activities should take place in cooperation and partnership with State and other organizations.

Full implementation of many specific action items from the 1995 Federal Fire Policy remains critical for the successful implementation of the 2001 Federal Fire Policy. The *Review and Update* contains a detailed listing of the status of those action items, along with appropriate future actions based on the 2001 Federal Fire Policy and associated implementation actions.

Guiding Principles

The 2001 Federal Fire Policy and its implementation are founded on the following guiding principles:

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
3. Fire management plans, programs, and activities support land and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
6. Fire management plans and activities are based upon the best available science.
7. Fire management plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among Federal agencies is an ongoing objective.

Homes destroyed by wildland fire in the wildland–rural interface on the American River in California. "The fire hazard situation in the wildland–urban interface," notes the 2001 Federal Fire Policy, "is more complex and extensive than understood in 1995." Photo: USDA Forest Service, 1992.

Key Themes

Ecosystem Sustainability. The 1995 Federal Fire Policy recognized the role fire plays as a critical natural process. This *Review and Update* builds on the 1995 *Federal Fire Policy Review* to include policies recognizing the role of fire in sustaining healthy ecosystems, the restoration and rehabilitation of burned lands, and the importance of sound science in fire management activities.

Fire Planning. The 1995 Federal Fire Policy requires fire management plans for all areas with burnable vegetation. Significant work remains to complete these plans for many areas. Many plans need updating and integration with underlying land management plans. Agencies such as the Departments of Defense and Energy need to coordinate their planning efforts based on the 2001 Federal Fire Policy. Fire management plans that address all aspects of fire management activities remain the foundation for implementing the 2001 Federal Fire Policy and must be completed as promptly as possible.

Fire Operations. The 1995 Federal Fire Policy statements on operational aspects of fire management, including safety, protection priorities, preparedness, suppression, use of wildland fire, prevention, and wildland–urban interface roles and responsibilities, are carried forward in the 2001 Federal Fire Policy. The 2001 Federal Fire Policy clearly states that response to wildland fire is based on the fire management plan, not the ignition source or location of the fire. The *Review and Update* recognizes the need to reach agreement on the requirements for weather products and services, and the best means to meet those requirements.

Fire management plans that address all aspects of fire management activities remain the foundation for implementing the 2001 Federal Fire Policy.

Interagency Coordination and Cooperation. A key theme of the 1995 Federal Fire Policy is the importance of standardization and interagency cooperation and coordination among Federal agencies and between Federal agencies and non-Federal organizations. The *Review and Update* recognizes the importance of including additional Federal land managing agencies (e.g., the Department of Defense and Department of Energy) and agencies with supporting or related programs (e.g., the National Weather Service, Environmental Protection Agency, U.S. Geological Survey, and Federal Emergency Management Agency) as full partners in wildland fire management activities and programs. The *Review and Update* also adds a specific policy on communication and education to ensure that the 2001 Federal Fire Policy is well understood inside the fire management agencies and by the public.

Program Management and Oversight. The Working Group found that there is no effective means of overseeing and evaluating implementation of fire policy, especially across agency and program lines. A new policy on evaluation is therefore included in the 2001 Federal Fire Policy. The need for a mechanism for coordinated interagency and interdisciplinary fire management program leadership and oversight is included in the implementation actions. Other actions to improve program management include analyses of workforce requirements and of fire management and suppression organizational structures. ■

Tabular Crosswalk Between the 1995 and 2001 Federal Fire Policies

Editor's note: The table below, based on the 2001 Review and Update of the 1995 Federal Wildland Fire Management Policy, *shows changes in Federal wildland fire management policy from 1995 to 2001.*

Policy element	*1995 Policy*	*2001 Policy*
Safety	Firefighter and public safety is the first priority. All fire management plans and activities must reflect this commitment.	Firefighter and public safety is the first priority. All fire management plans and activities must reflect this commitment.
Ecosystem sustainability	—	The full range of fire management activities will be used to achieve ecosystem sustainability, including its interrelated ecological, economic, and social components.
Response to wildland fire	Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, across agency boundaries, and will be based upon the best available science. All use of fire for resource management requires a formal prescription. Management actions taken on wildland fires will be consistent with approved fire management plans.	Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fires is based on ecological, social, and legal consequences of the fire. The circumstances under which a fire occurs and the likely consequences for firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate response to the fire.
Use of wildland fire	Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role.	Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role. Use of fire will be based on approved fire management plans and will follow specific prescriptions contained in operational plans.
Rehabilitation and restoration	—	Rehabilitation and restoration efforts will be undertaken to protect and sustain ecosystems, public health, and safety; and to help communities protect infrastructure.
Protection priorities	Protection priorities are (1) human life and (2) property and natural and cultural resources. If it becomes necessary to prioritize between property and natural and cultural resources, this is done based on relative values to be protected, commensurate with fire management costs. Once people have been committed to an incident, these resources become the highest value to be protected.	The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health and safety, and the costs of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.

Policy element	***1995 Policy***	***2001 Policy***
Wildland–urban interface	The operational role of Federal agencies as a partner in the wildland–urban interface is wildland firefighting, hazard fuel reduction, cooperative prevention and education, and technical assistance. Structural fire protection is the responsibility of tribal, State, and local governments. Federal agencies may assist with exterior structural suppression activities under formal fire protection agreements that specify the mutual responsibilities of the partners, including funding. (Some Federal agencies have full structural protection authority for their facilities on lands they administer and may also enter into formal agreements to assist State and local governments with full structural protection.)	The operational role of Federal and State agencies as partners in the wildland–urban interface are wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance. Structural fire suppression is the responsibility of tribal, State, or local governments. Federal agencies may assist with exterior structural protection activities under formal fire protection agreements that specify the mutual responsibilities of the partners, including funding. (Some Federal agencies have full structural protection authority for their facilities on lands they administer and may also enter into formal agreements to assist State and local governments with full structural protection.)
Planning	Every area with burnable vegetation must have an approved fire management plan. Fire management plans must be consistent with firefighter and public safety, values to be protected, and land and resource management plans and must address public health issues. Fire management plans must also address all potential wildland fire occurrences and include the full range of fire management actions.	Every area with burnable vegetation must have an approved fire management plan. Fire management plans are strategic plans that define a program to manage wildland and prescribed fires based on the area's approved land management plan. Fire management plans must provide for firefighter and public safety; include fire management strategies, tactics, and alternatives; address values to be protected and public health issues; and be consistent with resource management objectives, activities of the area, and environmental laws and regulations.
Science	—	Fire management plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors. Information needed to support fire management will be developed through an integrated interagency fire science program. Scientific results must be made available to managers in a timely manner and must be used in the development of land management plans, fire management plans, and implementation plans.
Preparedness	Agencies will ensure their capability to provide safe, cost-effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, and equipment.	Agencies will ensure their capability to provide safe, cost-effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, equipment, and management oversight.
Suppression	Fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.	Fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.

Policy element	*1995 Policy*	*2001 Policy*
Prevention	Agencies will work together and with other affected groups and individuals to prevent unauthorized ignition of wildland fires.	Agencies will work together and with their partners and other affected groups and individuals to prevent unauthorized ignition of wildland fires.
Standardization	Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values-to-be-protected methodologies, and public education programs for all fire management activities.	Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values-to-be-protected methodologies, and public education programs for all fire management activities.
Interagency cooperation	Fire management planning, preparedness, suppression, fire use, monitoring, and research will be conducted on an interagency basis with the involvement of all parties.	Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners.
Communication and education	—	Agencies will enhance knowledge and understanding of wildland fire management policies and practices through internal and external communication and education programs. These programs will be continuously improved through the timely and effective exchange of information among all affected agencies and organizations.
Agency administrator and employee roles	Employees who are trained and certified will participate in the wildland fire program as the situation demands; employees with operational, administrative, or other skills will support the wildland fire program as needed. Administrators are responsible and will be accountable for making employees available.	Agency administrators will ensure that their employees are trained, certified, and made available to participate in the wildland fire program locally, regionally, and nationally as the situation demands. Employees with operational, administrative, or other skills will support the wildland fire program as necessary. Agency administrators are responsible and will be held accountable for making employees available.
Evaluation	—	Agencies will develop and implement a systematic method of evaluation to determine effectiveness of projects through implementation of the 2001 Federal Wildland Fire Management Policy. The evaluation will assure accountability, facilitate resolution of areas of conflict, and identify resource shortages and agency priorities.
Economic efficiency	Fire management programs and activities will be based on economic analyses that incorporated commodity, noncommodity, and social values.	—

An Agency Strategy for Fire Management (Executive Summary)

Editor's note: In 1999, the USDA Forest Service commissioned a National Management Review Team to review chronic problems related to wildland fire management (see sidebar). On January 12, 2000, the team released An Agency Strategy for Fire Management. *The executive summary is reprinted here, lightly edited. The full report is posted on the World Wide Web at <http://www.fs.fed.us/fire/planning/USDA_Report.pdf>.*

Over the past 10 years, several significant programmatic reports have highlighted persistent and recurrent problems in wildland fire management. Major cultural and demographic changes in the workforce and significant programmatic changes in the agency have resulted in increased costs and a significant reduction in agency workforce participation on large fires. Without a significant organizational change, the overall ability to manage large fires will be compromised.

> Without a significant organizational change, our ability to manage large fires will be compromised.

Strategic Review

This report is a comprehensive and strategic examination of past reviews, policies, and direction for the fire management program.

The National Management Review Team consisted of representatives from Forest Service line officers, the National Fire Protection Association, the National Association of State Foresters, the National Park Service, the Brookings Institution, and Forest Service Fire and Aviation Management staff. A full range of alternatives (pathways) were developed, including designating a Federal fire service, an outsourced fire service, and a "national" large-incident management organization.

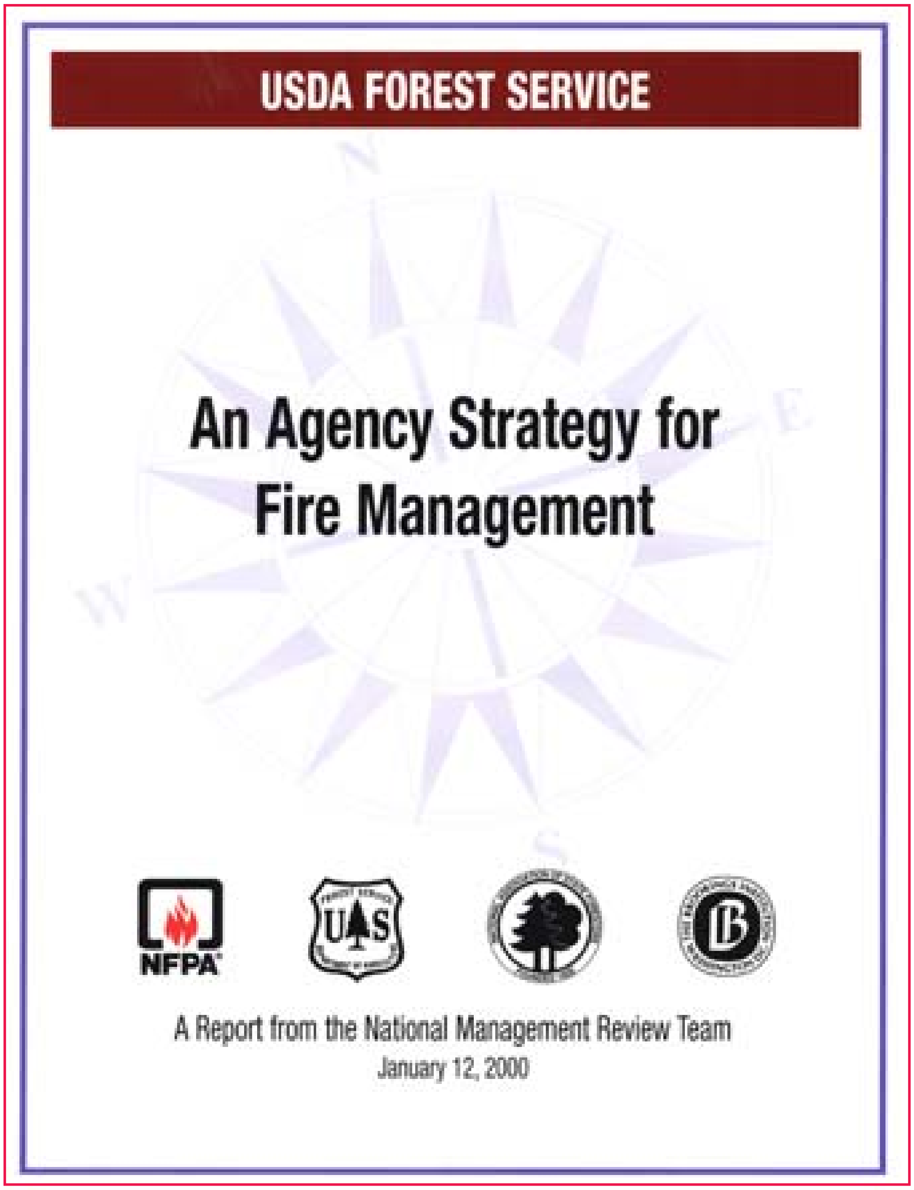
The primary finding of this review is that the current level of dedicated and available staffing for large-incident management is diminishing. Therefore, the following recommendations were developed to address this and other issues concerning large-incident management:

1. Develop and implement a national Large Incident Management Organization, dedicated and professional, to more effectively manage large-fire operations and natural disasters. The recommendation is predicated on building a strong local initial- and extended-attack fire program and implementing an aggressive ecosystem restoration program. This represents a significant departure from today's operation and will require a major commitment of people and resources.
2. Clearly articulate to the field that an independent Federal Fire Service will NOT be pursued or entertained. The linkage to the agency's land management mission is simply too important to divorce aspects of fire management and fire use from the agency.
3. Establish an Implementation Team comprised of a representative cross-section of interagency partners and interests. Oversight for implementation would be provided by the Forest Service's Deputy Regional Foresters for State and Private Forestry.
4. Establish a continuous monitoring process with annual reports on progress.
5. Assign an appropriate group to resolve issues raised by the State Foresters concerning the 1995 Federal Wildland Fire Management Policy and Program Review.

Pathway to Change

The recommended pathway is conceptual in nature. There are many actions necessary to successfully implement this pathway. Without a fundamental change in the way large fires are managed, we can expect to experience the problems of today well into the future, including a perceived lack of Forest Service capability to manage both wildfire and prescribed fire. ■

We need a strong local initial- and extended-attack fire program and an aggressive ecosystem restoration program.



Cover of the USDA Forest Service report An Agency Strategy for Fire Management *(January 2000). Changes in the agency workforce, coupled with a rising number of large fires in recent decades, have triggered new strategic directions for wildland fire management. "Without a fundamental change in the way large fires are managed," warns the report, "we can expect to experience the problems of today well into the future."*

Chronic Problems Call for a Change

Editor's note: The following excerpt from the introduction to An Agency Strategy for Fire Management *highlights the strategic challenges facing wildland fire management in the USDA Forest Service.*

The Chief of the Forest Service commissioned a review team to look into several unresolved and lingering problems related to the fire management program. The Forest Service fire and fuels program is not well integrated with the land management program of the agency. In some instances line and staff officer relationships regarding fire management are ineffective. The Forest Service's ability to provide adequate support to large fires is diminishing. Many cooperators and partners think the Forest Service is ineffective and inefficient in fire management. These four problems are chronic. They have been identified over and over in many reviews in the 1990s. These four problems need immediate resolution.

It is time for a change.

Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy (Executive Summary)

Editor's note: On October 13, 2000, the USDA Forest Service released Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy. *The report responded to a study by the General Accounting Office under the title,* Western National Forests: A Cohesive Strategy Is Needed To Address Catastrophic Wildfire Threats. *The executive summary of A Cohesive Strategy is reprinted here, lightly edited. The full report is posted on the World Wide Web at <http://www.fs.fed.us/pub/fam/Cohesive-Strategy-00oct13.pdf>.*

Premise

This strategy is based on the premise that sustainable resources are predicated on healthy, resilient ecosystems. In fire-adapted ecosystems, some measure of fire use—at appropriate intensity, frequency, and time of year—should be included in management strategies intended to protect and sustain watersheds, species, and other natural resources over the long term.

The strategy is also based on the premise that, within fire-adapted ecosystems, fire-maintained forests and grasslands are inherently safer for firefighters and the public than ecosystems in which fire is excluded.

Purpose

The strategy establishes a framework that restores and maintains ecosystem health in fire-adapted ecosystems for high-priority areas across the interior West. In accomplishing this, it is intended to:

- Improve the resilience and sustainability of forests and grasslands at risk;
- Conserve high-priority watersheds, species, and biodiversity;
- Reduce wildland fire costs, losses, and damages; and
- Better ensure public and firefighter safety.

In fire-adapted ecosystems, fire-maintained forests and grasslands are inherently safer for firefighters and the public.

Priorities

Wildland–urban interface. Wildland–urban interface areas include areas where flammable wildland fuels are adjacent to homes and communities.

Readily accessible municipal watersheds. Water is the most critical resource in many Western States. Watersheds affected by uncharacteristic wildfire effects are less resilient to disturbance and unable to recover as quickly as those that remain within the range of ecological conditions characteristic of the fire regime under which they developed.

Threatened and endangered species habitat. The extent of recent fires demonstrates that in fire-adapted ecosystems few areas are isolated from wildfire. Dwindling habitat for many threatened and endangered species will eventually be affected by wildland fire. The severity and extent of fire could eventually push declining populations beyond recovery.

Maintenance of existing low-risk condition class 1* areas. This is especially important in the Southern and Eastern States, where high rates of vegetation growth can eliminate the effects of treatment in 5 to 10 years. Recent droughts have caused severe wildland fire problems in Florida and Texas.

Elements

For the purposes of this report, these are the elements of a cohesive strategy:

- Institutional objectives and priorities,
- Program management budgets and authorities, and
- Social awareness and support.

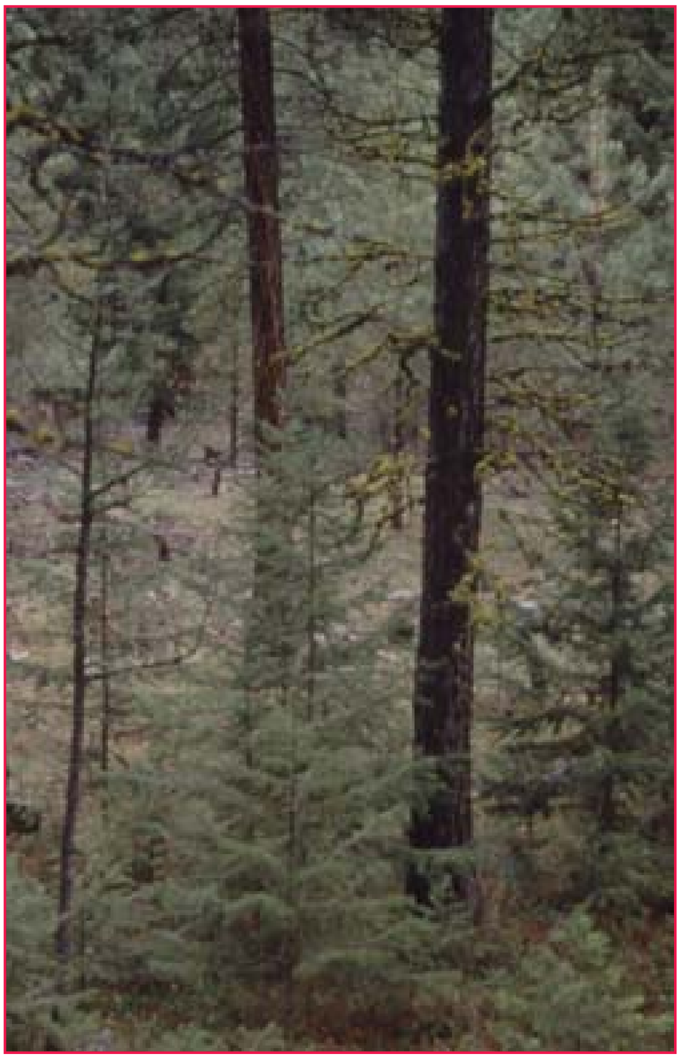
The strategy is based on the alignment of these institutional, program management, and constitu-

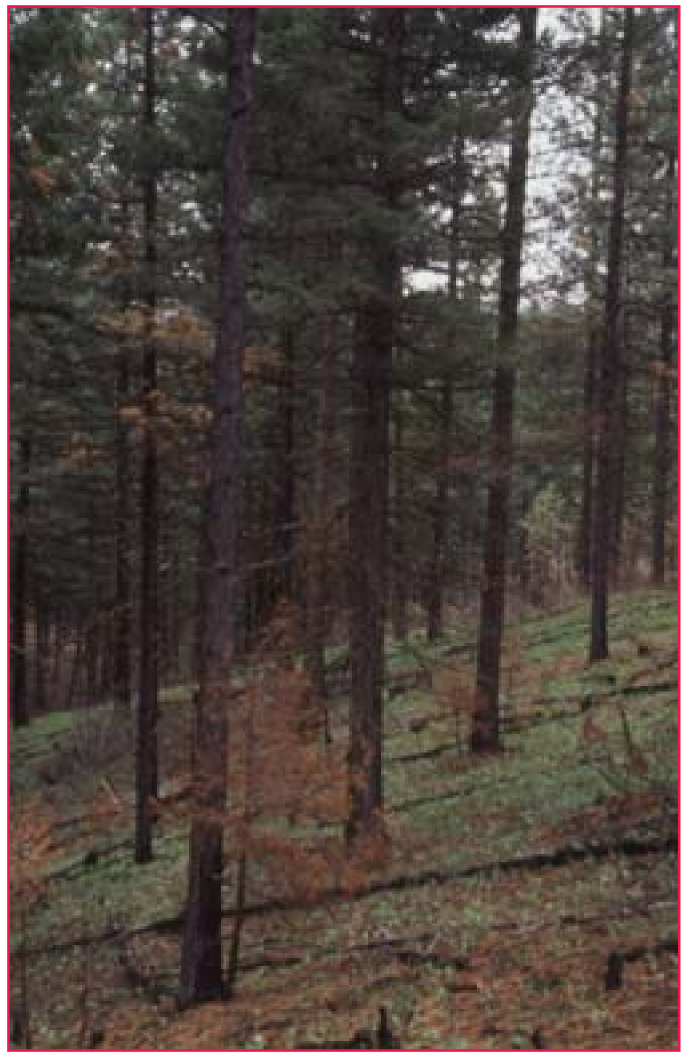
* Condition classes signify fire risk to ecosystem health based on departure from the historical fire regime due to human interventions such as fire exclusion. Risk ranges from class 1 (low risk), to class 2 (moderate risk), to class 3 (high risk).

Dwindling habitat for threatened and endangered species will eventually be affected by wildland fire.

ency elements. The cohesion of this strategy stands on the collective strength of these three core elements.

Within the Forest Service, ecosystem management concepts continue to evolve into practice. This report describes a cohesive set of actions from which the Forest Service may choose to initiate restoration and maintenance objectives within fire-adapted ecosystems. ■





Open ponderosa pine forest with Douglas-fir understory before (left) and after (right) a prescribed fire (Lick Creek drainage, Bitterroot National Forest, MT). By reducing ladder fuels, the burn diminished the danger of an uncharacteristically severe fire. Photos: Robert C. Szaro, USDA Forest Service, Pacific Northwest Research Station, Portland, OR, 1990.

Water is the most critical resource in many Western States.

Reducing Fire Danger: Is Current Policy on Course?

Hutch Brown

Fire-related forest health problems in the United States are a growing national concern. Today, millions of acres are at risk from fires that could threaten lives, communities, and wildland resources. Most people agree that fuel buildups after decades of fire exclusion are at the root of the problem—but here the agreement ends.

The USDA Forest Service, supported by extensive scientific assessments (COS 1999; ICBEMP 2000; OAHS 1999; SNEP 1996; Thomas 2000), is taking a balanced approach to restoring forest health, one that focuses on ecological sustainability and a desired future condition for the land (Dombeck 2001a; Forest Service 2000). Depending on location and site conditions, treatments include silvicultural thinning and fire use (Dombeck 2001b). The goal is to restore the composition, structure, and processes associated with healthy forest ecosystems, including historical fire regimes.

Critics charge that the Forest Service is pursuing the "tinderbox policies" of letting forests "rot and burn" (AF&PA 2001; Nelson 2001). They blame the Forest Service's "policy of passive management and ecological preeminence" for putting "our national forests in their present condition" (AF&PA 2001). They accuse the agency of an illicit "'mission shift' away from a focus

Hutch Brown is the managing editor of Fire Management Today*, USDA Forest Service, Washington Office, Washington, DC.*

The goal is to restore healthy forest ecosystems, including historical fire regimes.

Open ponderosa pine forest with Douglas-fir understory before (top) and after (bottom) mechanical low thinning. The understory ladder fuels constituted a fire hazard, making fire use unsafe before their removal. Photos: Tom Iraci, USDA Forest Service, Pacific Northwest Region, Portland, OR, 1992.

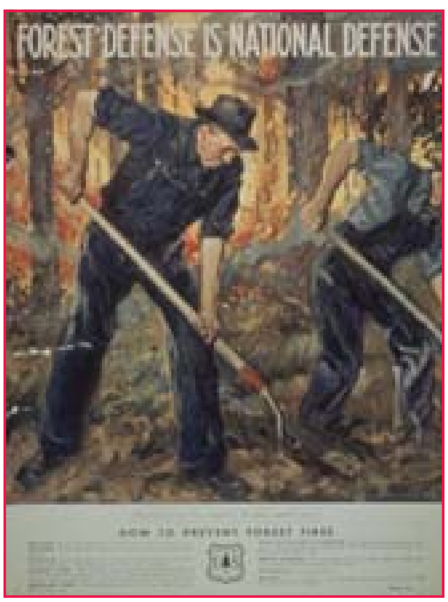
For decades, the Forest Service treated all fire, regardless of type or site, as a threat to forest health.

on multiple outputs” (AF&PA 2001; Sedjo 2000), demanding a return to “a clear utilitarian goal” of managing public lands “as valuable sources of wood, recreation and other outputs” (Nelson 2001). The solution to our forest health problem, critics claim, is to boost timber harvest to “remove much of the excess fuels by mechanical means” (Nelson 2000a, 2000b).

Is the Forest Service policy wrong? Are land managers practicing the very treatments that caused forest health to decline? Are increased timber outputs the answer?

Origins of Fire Control

Americans have long struggled with conflicting notions of sustainable forest management. One of the first to wrestle with the problem was Gifford Pinchot, the first Forest Service Chief. Pinchot’s conservationism was born of profligate abuse by preceding generations. “When the Gay Nineties began,” he recalled, “the common word for our forests was ‘inexhaustible.’ To waste timber was a virtue and not a crime” (Pinchot 1947).



Fire prevention poster from 1941. During World War II, the Forest Service conflated its fire control mission with national defense, reinforcing the traditional approach to wildland fire management as “the moral equivalent of war.” Illustration: USDA Forest Service.

Most early lumbermen clearcut virgin forests for the best sections of bole, leaving huge mounds of slash on cutover lands. Lightning or artificial flames often ignited the slash, causing enormous wildfires that swept the countryside. For loggers, the trick was to harvest the next virgin stand before flames “roared out of the slash and left nothing for them to mill,” in the words of the historian Stephen J. Pyne (2001). Under such circumstances, “only a madman [would] consider replanting the cutover.”

One such “madman” was Pinchot. Recognizing the abuse, Pinchot resolved to end the waste by pioneering sustainable forestry on public lands—the national forests—as a model for the nation. Influenced by European industrial forestry, Pinchot maintained that intensive land management for commercial resource extraction was the cornerstone of conservation. “Forestry is handling trees so that one crop follows another,” he declared (Pinchot 1947). Forest benefits such as soil and water conservation were, in Pinchot’s view, “other products on the side”—byproducts of growing “trees as a crop.”

Pinchot’s approach to conservation helped to inaugurate the extractive model of forestry prevalent in public land management from the 1890s to the 1970s (Kennedy and Dombeck 1999). Fire control was key. Pinchot and his successors as Forest Service Chief “never doubted what to his generation of American foresters seemed the most fundamental of precepts: Without fire control nothing else mattered” (Pyne 2001). For forestry to succeed, land managers believed, the tree crop would have to be protected from every fire (Greeley 1920). Fire protection became central to the agency’s mission; fire exclusion remained, in one form or another, the prevalent agency doctrine until 1977.

Through a decentralized organization, the early Forest Service worked closely with local homesteaders and communities to meet their needs. The agency’s earliest *Use Book* instructed forest officers to provide settlers, schools, churches, road districts, and cooperative associations with goods and services for free or at a nominal charge but to require full payment from commercial enterprises (Pinchot 1947). In the 1930s, the agency reaffirmed its commitment to the common good by giving work on conservation projects to thousands of unemployed Americans through the Civilian Conservation Corps (CCC).

The CCC, followed in the postwar period by aircraft and other firefighting technologies, provided the means to extend fire control into the backcountry (Pyne 1982). The number of acres burned annually nationwide declined from an average of 39 million in the 1930s to less than 5 million by the 1960s. For decades, the Forest

Service enjoyed such high levels of public confidence that it was largely able to regulate itself through the *Use Book* and other administrative guidelines.

> "In free use, as in timber sales, the welfare of the forest must come first."
>
> –*Gifford Pinchot, 1947*

Timber Boom

Things began to change after World War II, when the Forest Service delivered vast quantities of old-growth timber to the mills to help support the postwar housing boom. In the process, local ties gave way to corporate connections. A timber boomlet in the 1920s foreshadowed events to come.

In 1915, a logging company from Kansas City, MO, built a mill in Enterprise, OR, a small town on the edge of the Wallowa National Forest. Citizens welcomed the new jobs and related business, confident that the Forest Service would provide long-term resource protection. The Forest Service fed the mill through timber sales, consistently offering the highest allowable sale quantities.

By 1928, the prime timber was gone and the mill had closed. "What is so depressing is that there was nothing at all unusual about this story," remarked the historian Nancy Langston (1995). "A small town pinned its hopes on a single natural resource, and soon that resource was exhausted. The capital for development came from somewhere else, and that company pulled out after the lumber was cut and the investments met. The locals were left holding an empty bag."

Initially, such cases were rare, because the timber industry usually tried to keep national forest timber off the market to help sustain high prices for private timber (Williams 2000a). But after World War II, with private stocks depleted, the industry clamored for national forest timber. The Forest Service obliged, consistently offering the greatest annual allowable cut (Fedkiw 1999). Annual harvests quadrupled, from less than 3 billion board feet in the early 1940s to more than 12 billion board feet by the mid-1960s. Long-term planning was for still higher outputs: The 1961 Development Program for National Forests projected annual harvests of 21.1 billion board feet by the year 2000.

Ninety percent of the increase in national forest timber harvests from 1950 to 1970 came from western old-growth forests (Fedkiw 1999). Forest Service managers regarded old growth as "decadent" or "overmature" and welcomed its removal for replacement by faster growing stands, thought to be a continuous crop of timber that could support local businesses forever. "But this formula never worked," concluded Langston (1995). As in the case of Enterprise in Oregon, mills closed and futures collapsed as soon as the local resource was exhausted or markets were saturated (Hirt 1999).

Undeterred, the Forest Service continued to collaborate with the timber industry. The revenue flow was habit forming, even when sales were below cost. Timber harvests drove forest development; forest supervisors overcame budget limitations by using new roads and timber funds for other management purposes (Fedkiw 1999). Conversely, values and activities that failed to generate revenue were seen as constraints. Long-term benefits such as watershed integrity were overlooked in favor of short-term benefits from timber receipts.

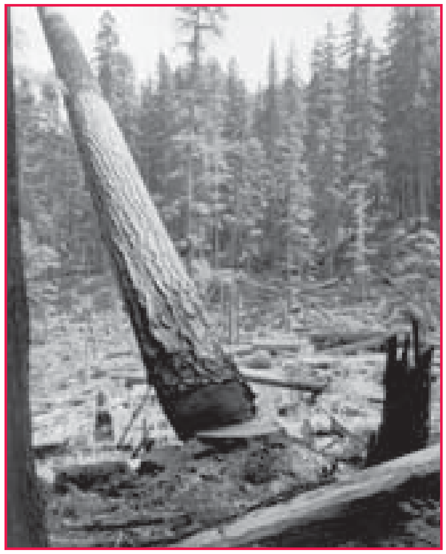
In 1964–65, slope failure on Idaho's Boise and Payette National Forests sent 1.5 million cubic yards (1.1 million m^3) of soil slumping into the South Fork Salmon River and its tributaries, degrading water quality and salmon habitat in much of the Columbia River basin. The cause was roadbuilding and logging on steep slopes weakened by decades of abuse through mining and grazing (Fedkiw 1999). Clearly, the byproducts that Pinchot had expected from growing "trees as a crop"—clean water and abundant soils—could no longer be taken for granted.

New Model of Sustainability

By the 1970s, the extractive model for managing the land was discredited (see sidebar). The Forest Service was embroiled in a national controversy over clearcuts on the Bitterroot and Monongahela National Forests, further staining the agency's now tarnished reputation. Broad sectors of the public demanded a return to a bedrock Forest Service principle first formulated by Gifford Pinchot (1947): "In free use, as in timber sales, the welfare of the forest must come first."

In the 1930s, the great ecologist Aldo Leopold had recognized the need and set the stage. German-speaking by birth, he visited Germany to study the origins of what he called "the wood factory concept" of forestry (Leopold 1936a). Germany's new, holistic approaches to land management, designed to reverse some of the worst damages wrought by industrial forestry, impressed Leopold. "The Germans now realize," he observed, "that increment bought at the expense of soil health, landscape beauty, and wildlife is poor economics as well as poor public policy."

Based in part on Leopold's insights, a new resource management model began to emerge. In 1970, Forest Service Chief Edward Cliff called for "an ecosystem approach to multiple-use management" (Fedkiw 1999). In the years that followed, researchers laid the groundwork for ecosystem-based management through ecoregional mapping and "new forestry" approaches.



A large Douglas-fir toppling on the 1949 Iron Creek Timber Sale, Gifford Pinchot National Forest, WA. Postwar timber harvest on the national forests soared to support a housing boom. Ninety percent of the increase from 1950 to 1970 came from western old-growth forests. Photo: Courtesy of USDA National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD (Leland J. Prater, 1949; 456997).

Chief F. Dale Robertson, speaking before Congress in 1992, renewed the call for an ecosystem-based approach to multiple-use management. In 1993, following a regional Forest Conference convened by President Bill Clinton in Portland, OR, the Northwest Forest Plan created the first blueprint for ecosystem-based management across jurisdictions on a landscape level. By protecting old-growth habitat for the northern spotted owl, the plan slowed a stream of lawsuits that had paralyzed public land management in the Pacific Northwest.

Robertson's successor as Forest Service Chief, Jack Ward Thomas, echoed the call for an ecosystem-based approach. He defined its goal as ecosystem sustainability: Land and resource use must not be allowed to undermine the health,

A Land Use Revolution

The postwar period saw a revolution in public land use. In 1946, our national forests and grasslands hosted just 18 million visitor-days. By 1965, that figure topped 160 million; by 1996, it was 341 million, an 18-fold increase in just five decades. Recreational use eclipsed commercial resource extraction on public lands. By 1996, some 1.7 million recreational vehicles were using roads on the national forests every day—about 117 times more than the 15,000 logging vehicles sharing the same forest roads.

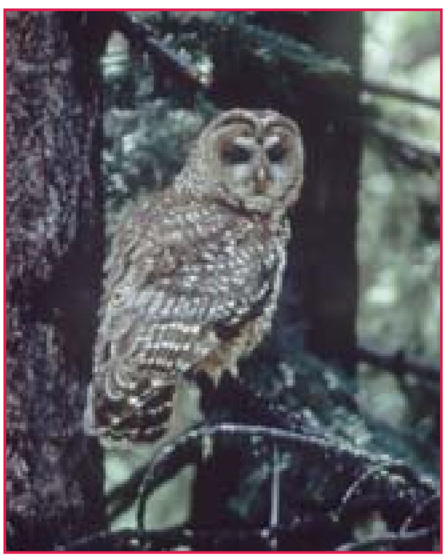
The public land use revolution reflected changing demographics. In Gifford Pinchot's day, the American population was about evenly divided between rural and urban citizens, with relatively few city dwellers venturing onto public wildlands (Fedkiw 1999). The goal implicit in the USDA Forest Service's early *Use Book* of managing public lands primarily to meet the homesteading needs of rural citizens therefore made sense. By 1990, however, that goal was obsolete. Four-fifths of all Americans were now urban and most were driving. Many spent weekends or vacations on public lands, where they expected to find pristine conditions for adventure, relaxation, and spiritual renewal. Public land managers would ignore their expectations at their own peril.

Discontent began to build in the 1950s. As more Americans visited their public lands, protests grew against clearcuts, mining scars, and watershed degradation. Increasingly, the public perceived a collusion between Federal agencies and commercial interests in degrading the land for the profit of a privileged few. In response, Congress passed a series of laws in the 1960s and 1970s providing greater environmental protections and requiring a more comprehensive approach to managing public lands, including increased public participation.

Public land managers were initially slow to respond, but a new approach to land management gradually emerged. Today, based on the principle of sustainability, the Forest Service focuses on maintaining and restoring healthy ecosystems as a foundation for all the values and benefits that Americans obtain from their public lands.

diversity, or productivity of ecosystems on which future generations will depend for a continuous flow of resource benefits.

In 1997, the Secretary of Agriculture appointed a Committee of Scientists to guide the Forest Service in revising its planning rule under the National Forest Management Act of 1976. The committee validated the principle of sustainability, including conservative use (see sidebar). "[P]lanning for the multiple use and sustained yield of the resources of the national forests and grasslands," the committee advised, "should operate within a baseline level of ensuring the sustainability of ecological systems and native species. Without ecologically sustainable systems, other uses of the land and its resources could be impaired" (COS 1999). Based on the committee's report, the Forest Service drafted a new rule for national forest management planning, promulgated in December 2000.



Northern spotted owl. Rapid postwar harvest of old-growth timber in the Pacific Northwest reduced habitat for the owl, leading to its listing as threatened. In the mid-1990s, the Northwest Forest Plan created the first blueprint for ecosystem management across jurisdictions on a landscape level, protecting remaining old-growth habitat for the owl. Photo: USDA Forest Service.

> "Without ecologically sustainable systems, other uses of the land and its resources could be impaired."
>
> *–Committee of Scientists, 1999*

What exactly is sustainability? Sustainability replaces an emphasis on commodity extraction with a broader, more multiple-use focus on all the benefits and values that healthy lands provide. It up-ends the old extractive model: Instead of trusting that soil and water conservation will emerge as a byproduct of growing "trees as a crop," sustainability focuses directly on restabilizing soils and waterflows—on restoring the function, structure, and composition of historical ecosystems. The trees that will then inevitably grow, including those removed and used for wood fiber, are the byproducts of healthy forest ecosystems.

Sustainability is based on a simple truth: On healthy lands, Federal land managers can meet their statutory obligations to deliver a full range of uses, including commercial outputs; on degraded lands, they cannot. In the best tradition of Progressive-Era conservation, sustainability serves the long-term interests of all Americans—or, as Gifford Pinchot (1947) put it, "the greatest good for the greatest number for the longest time."

Shift in Fire Management

The ecosystem approach to land management signaled a parallel shift in wildland fire management. Long before, fire exclusion had been formally adopted by the Forest Service through the 10 A.M. Policy promulgated in 1935. Nevertheless, the agency had continued to conduct prescribed burns in the South, and support for fire use had lingered (Brown 2000; Williams 2000b). From the 1930s to the 1960s, research by the Forest Service's Southern and Southeastern Forest Experiment Stations supported the independent findings of E.V. Komarek and the Tall Timbers Research Station, demonstrating the ecological role played by wildland fire in ecosystems.

By the 1960s, the exponential growth of fire suppression costs and the persistence of occasional severe fire seasons were raising new doubts about the viability of fire exclusion as a national policy (NWCG 2001). Promoted by passage of the Wilderness Act in 1964, which limited human intervention in wilderness areas, an alternative policy began to emerge. In 1967, the Forest Service relaxed controls on early- and late-season fires; a year later, the USDI National Park Service abandoned fire exclusion altogether. In 1977, the Forest Service followed suit, replacing the 10 A.M. Policy and its variant, the 10-Acre Policy, with a flexible policy that allowed local fire managers to consider alternatives to full suppression, including the use of fire.

The 1988 Yellowstone Fires and the 1994 fire season, with its 34 fatalities, placed fire management policy under renewed scrutiny. Each time, review teams reconfirmed a flexible policy incorporating fire use. In

Ecosystem-based land management precipitated a parallel shift in wildland fire management.

1995, an interagency wildland fire management policy emerged to help coordinate activities across jurisdictions. The 1995 Federal Fire Policy was based on the insight that fire was "a critical natural process" that should be "integrated into land and resource management plans and activities on a landscape scale" (NWCG 1995). In 2001, despite a high-visibility prescribed fire escape near Los Alamos, NM, in May 2000,* a top-level interagency policy review and update reconfirmed the wisdom of carefully planned fire use, generating the 2001 Federal Fire Policy (NWCG 2001).

Today, wildland fire management on our national forests and grasslands serves the overarching goal of sustainability. "The full range of fire management activities will be used to achieve ecosystem sustainability," declares the 2001 Federal Fire Policy, "including its interrelated ecological, economic, and social components" (NWCG 2001). Land managers are to use all the tools at their disposal, including fire suppression and fire use, to achieve a desired future condition for the land. Outcomes, not outputs, are key.

Difficult Course Ahead

Ultimately, policy is meaningful only if practiced. Fire use to support sustainable forest management must overcome a powerful legacy of fire control (see sidebar on page 25). The course ahead will not be easy.

Fire exclusion is deeply ingrained in the culture of wildland fire management. The Forest Service was founded on an extractive model of forestry and, by corollary, a policy of fire exclusion. For decades, the agency focused on maximizing resource extraction, based on "the uncritical assumption," as Aldo Leopold (1936b) put it, "… that the practice of forestry in and of itself, regardless of what kind or how much," promotes conservation.

The grand experiment ended in failure. Today, some 71 million acres of national forests are at risk from wildland fires that could compromise ecosystem integrity and human safety (F&AM 2001). Our fire problem stems in good part from the policy of fire exclusion inaugurated by the early Forest Service to make public lands safe for growing "trees as a crop."

Stephen J. Pyne, America's leading wildland fire historian, has frequently chronicled the "ecological pandemonium" associated with European settlement and the removal of indigenous burning from America's landscape. Fire exclusion greatly exacerbated the disruption of historical fire regimes and ecosystem health. The celebration of fire control through the cultivation of epic tales of firefighting, beginning with the Big Blowup of 1910, has troubling implications for the long-term effectiveness of fire protection in the United States (Pyne 2000, 2001).

Pyne (2001) observes that the Forest Service's long obsession with fire control has created forests that

* See Jim Paxon, "'Remember Los Alamos': The Cerro Grande Fire," *Fire Management Today* 60(4): 9–14.

Conservative Use: A Principle of Sustainability

Sustainability means, among other things, conservative use to keep options open for future generations. For example, we know from experience that fire use can be a sound method for diminishing fuels, reducing fire danger, and restoring forest health. We are far less certain about commercial timber harvest as a forest health treatment.

Some research suggests that changes in forest structure and composition associated with roadbuilding and timber harvest can increase the risk of uncharacteristic fire effects (Thomas 2000). Moreover, we do not fully understand the impacts of timber removal on forest health, particularly on nutrient cycles and on species interrelationships in forest soils and canopies.

We do know that roadbuilding and logging operations, especially if best management practices are ignored, can disrupt fire cycles; compact and erode soils; increase runoff and stream siltation; alter forest composition and structure; and eliminate valuable habitat for threatened and endangered species. For these reasons, timber harvest on public lands is controversial. Conservative use therefore dictates caution in applying mechanical timber removal as a method for restoring forest health.

cannot “readily accept light fires,” leaving managers caught in a bind: If they set fire or let burn, they risk destroying what they would protect; if they suppress fire, fuel conditions will further deteriorate, increasing the fire danger. For fire managers, the necessary task of navigating between the Scylla of a fire escape and the Charybdis of spiraling fuel buildups will not be easy.

Today, wildland fire management on our national forests and grasslands serves the overarching goal of sustainability.

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Fire in an intensively managed area with evident past clearcuts. Overstory removal stimulates vigorous regeneration (foreground); young trees are often less fire resistant than mature forest and more likely to fuel a severe fire. Photo: USDA Forest Service.

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Fire Control Legacy

In recent decades, the USDA Forest Service has embraced a long-term commitment to ecological sustainability. However, decades of fire control have made it difficult for local managers to introduce alternatives to fire exclusion.

- ***Fire use constraints.*** Managers might have no alternative to fire exclusion. Fuel buildups have left many ecosystems prone to explosive fire conditions. In such areas, fire use could pose unacceptable risks.
- ***Planning inertia.*** In 2000, some 63 percent of the acres burned on the National Forest System were in roadless and wilderness areas (F&AM 2000a). Remote areas are often in the stand replacement fire regime, where alternatives to full suppression are desirable and arguably inevitable. But alternatives are available only with an approved fire management plan.
- ***Thinning constraints.*** Mechanical thinning, often necessary before fire can be safely applied, is expensive and controversial. The small-diameter materials that need to be removed from our vegetation-choked forests usually have little or no commercial value. The ecological effects of mechanical treatments are sometimes adverse or poorly understood; proposals for mechanical removal therefore face frequent public opposition.
- ***Obsolete measures.*** Standards for measuring fire management success are based on the old fire control policy of suppressing all fires within 24 hours.
  - ***Number of fires and acres burned.*** All fires are not equal. The Forest Service is working on plans to use new technology to detect fire severity in relation to fire regime and condition class. Future fire reporting might distinguish, for example, between characteristic and uncharacteristic fire effects, for a more realistic assessment of fire season severity.
  - ***Fires controlled during initial attack.*** Nominal success—up to 98 percent of fires controlled during initial attack—can be misleading. For example, many fires might go out on their own without ever endangering lives, communities, or wildland resources.
- ***Fire use risks.*** Fire use carries social and political risks.
  - ***Escapes.*** Escaped prescribed fires have destroyed thousands of homes and cost at least one life (on the 1980 Mack Lake Fire on Michigan's Huron–Manistee National Forest). High-visibility escapes such as the 2000 Cerro Grande Fire in New Mexico have a political fallout that can dampen land managers' willingness or ability to take the risk again.
  - ***Smoke.*** Lingering smoke from fire use can carry health risks, contribute to traffic accidents by reducing visibility, and adversely affect incomes in resource-dependent communities by discouraging recreational visits. However, wildfires have the same effects without the benefits associated with planning, such as timing, predictability, and mitigation.
  - ***Public antipathy.*** The public, weaned on a diet of fire control, often fears wildland fire and opposes its use.

Fires 2000: Fact vs. Fiction*

Stephen W. Barrett

In 2000, about 2.3 million acres (930,000 ha) burned in Idaho and Montana alone. Many wondered why the fire season in the northern Rocky Mountains was so severe. A medley of conflicting opinions emerged, often grounded in folk wisdom:

- "The fires were big and therefore unnatural." … *or* … "The fires were natural and therefore big."
- "The fires were unprecedented in history." … *or* … "Such burning has always occurred."
- "This was the worst fire season in 50 years." … *or* … "This was the best fire season in 50 years. Everyone knows fire is natural, so what's the problem?"

What does the science show?

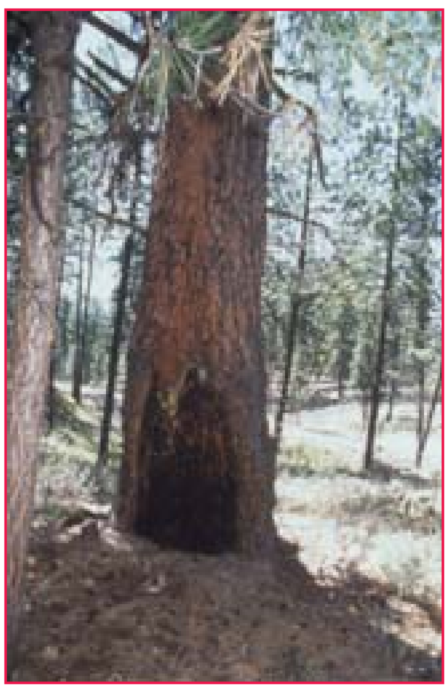
For some forests burned in 2000, still on a natural fire cycle, forest health was not an issue.

Complex Circumstances

In fact, there are no easy scientific answers. One must evaluate not only possible changes from historical fire regimes, but also climatic variables, daily fire weather, topography, land use history, and a host of other factors. Some forests burned in 2000 were still on a natural fire cycle (see sidebar); for them, forest health was not an issue.

However, many low- to mid-elevation stands have undergone a sea change since 1900, most notably the ponderosa pine type. In theory, a region increasingly dominated by severe fires will suffer a reduction in biodiversity. Forest mosaics—the very lifeblood of ecosystem diversity—are drastically simplified when large crown fires occur on terrain previously subject to patchy nonlethal and mixed-severity fires.

I think today's large wildfires are simply nature's way of lurching back to equilibrium after a century of fire suppression and bad logging. Unfortunately, the healing process could be lengthy and might generate some "casualties" in native ecosystems. For example, how will goshawks fare in today's overly dense ponderosa pine forests? How much longer will the 500-year-old trees themselves persist?



Fire scar on a ponderosa pine in the nonlethal fire regime (Idaho City Experimental Forest, Boise National Forest, ID). Historically, low-severity fires every 10 to 20 years kept such forests open and "parklike" without killing the big trees. Photo: Karen Wattenmaker, USDA Forest Service, Boise National Forest, Boise, ID, 1994.

No Easy Solutions

What can be done about the "fire problem?" Not much. Although I generally support plans for more prescribed fire, most prescribed burning occurs on "easy ground" such as open slopes and shrubfields. Prescribed burning in heavily stocked stands, besides being a threat to lives, communities, and wildland resources, actually could increase the likelihood of severe fires in the near term by producing heavy mortality.

Moreover, "restoration logging" has become a political football akin to the infamous "Salvage Rider"—the 1995 Rescission Act, which temporarily suspended environmental protections to foster widespread salvage sales on national forest land burned in 1994. In my view, the growing clamor for large-scale, indiscriminate thinning only harms foresters' credibility. Open, parklike stands historically were common in dry forest types, whereas other forests were naturally dense. Thinning the latter would destroy

Steve Barrett, a consulting fire ecologist in Kalispell, MT, has studied fire history throughout the Northern Rockies since 1979.

* This article is derived from an op-ed column that appeared in the Montana Wilderness Association's newsletter *Wild Montana*, Fall 2000.

valuable habitat and could increase fire danger by promoting fuel drying.

If ecosystem restoration were the only goal, there could be no universally applicable model of parklike stands. Unfortunately, other objectives, such as fuel hazard reduction and crop tree protection, have often been lumped into the now amorphous term "forest restoration." I think managers (and politicians) should clearly spell out the purposes of proposed thinning projects. But where true restoration is the goal, converting stands into simple tree farms—akin to steep cornfields—would be a big mistake ecologically and politically.

Healthy Backcountry

Given the politics, the massive scale of fire exclusion in the Northern Rockies, and the limited potential for bona fide restoration through prescribed burning and low-impact logging, I have to conclude that ecosystem restoration is unlikely to happen beyond a few demonstration projects. So let's thank our lucky stars for the wild backcountry—still some of the least impacted land on the planet! ■

Fire Ecology Primer*

Fire-prone ecosystems are adapted to certain "fire regimes"—typical combinations of fire severity and fire return intervals. Changes in fire regime can disrupt fire-adapted ecosystems. In the Northern Rockies, six fire regimes are prevalent:

Nonlethal fire regime. Historically, "nonlethal" fires averaged every 10 to 20 years, producing many open, "parklike" stands of ponderosa pine. Data from my extensive fire history research suggest that 80 years or more have passed since the last natural light underburns. The heavily disrupted fire pattern is a direct result of long-term fire exclusion; therefore, many stands will die during the next event. (Presumably, the same fate befell most old-growth ponderosa pine stands that burned in the 2000 fires.)

Mixed-severity (MS) I fire regime. The MSI fire regime is a variant of the nonlethal regime, but fires were occasionally more severe. Examples are stands dominated by ponderosa pine, Douglas-fir, and western larch in western Montana; and dry Douglas-fir stands in southwestern Montana. Fires averaged every 25 to 40 years on such sites, but have not occurred during the past 100 years, on average. Consequently, future wildfires will likely be more severe and perhaps larger.

MSII fire regime. This is a variant of the "stand replacement" regime (described below). Fires were often relatively severe, but some fire-resistant species such as old western larch and Douglas-fir usually survived. Such stands burned about every 75 years, on average, but many have not burned for 100 years or more. These stands are still natural, but long-term fire exclusion has pushed many fire intervals toward the upper end of the historical range. Modern fires will therefore be large and hot.

Stand replacement (SR) I fire regime. In the stand replacement fire regime, relatively long intervals occurred between severe fires that killed most trees in the stand. In the SRI fire regime, fire intervals usually ranged between 100 and 150 years long. Although fire exclusion has not affected most stands, the practice of continually extinguishing ignitions over a broad area has adversely affected some large landscapes.

SRII fire regime. In this fire regime, fire intervals usually exceeded 200 years in length. A good example of the SRII fire regime is Yellowstone Park's lodgepole pine forest.

MSIII fire regime. This fire regime type occupies the upper tree line, where historical fire intervals, severities, and sizes exhibit extreme variation. For example, some alpine larch and whitebark pine stands have gone many centuries without fire, whereas nearby trees sometimes contain multiple fire scars. Consequently, high-elevation communities show no measurable effect from long-term fire exclusion.

**Some fire regime classification schemes differ slightly from the one presented here. For the scheme used by the USDA Forest Service, see* Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy *(Washington, DC: USDA Forest Service), p. 70.*

A Consistent Wildland Fire Risk Terminology Is Needed!*

Andreas Bachmann and Britta Allgöwer

Even a casual familiarity with the literature related to wildland fire risk will reveal the inconsistent and confusing use of the terms "danger," "hazard," and "risk." Lack of clear definitions can be an obstacle to sound research and management. For example, computer models and simulations of "fire danger" or "fire hazard," if based on fuzzy definitions, are difficult to validate; a comparison of research results can be impossible if different researchers are really talking about different things. Moreover, unless firefighters on the fireline base their actions on precisely understood conditions, the consequences might be fatal. The success of any organization depends on a clear understanding of terms, rules, limits, and conditions.

Quantitative risk analysis in the context of wildland fire management requires a solid basis in a sound terminology that is understood and shared throughout the wildland fire community. First, let's look at another form of risk management—the field of technical risk engineering—for terminological options and alternatives to our current definitions (see sidebar). Then let's see if they can be usefully applied to wildland fire research.

Andreas Bachmann is a research assistant and Ph.D. student at the Institute of Geography, University of Zurich, Zurich, Switzerland; and Britta Allgöwer is a research associate at the University of Zurich and leads the geographic information system for the Swiss National Park.

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The success of any organization depends on a clear understanding of terms, rules, limits, and conditions.

"Risking" Redefinitions

Current wildland fire glossaries illustrate problems with the definitions of "fire danger," "fire hazard," and "fire risk." The field of technical risk engineering offers alternatives.

Fire Danger. Current glossaries define the term "fire danger" very broadly. For example, the National Wildfire Coordinating Group's *Glossary of Wildland Fire Terminology* (NWCG 1996) defines fire danger as the "sum of constant danger and variable danger factors affecting the inception, spread, and resistance to control, and subsequent fire damage." This definition conflates fire danger "factors" that are really quite different. For example, a fire's inception has to do with the probability of its occurrence, whereas resistance to control is related to the fire's outcome. It makes more sense to treat each factor separately to determine its relative contribution to the risk of fire. The term "danger" is too abstract and subjective to be useful for research and management.

New Definitions

Based on definitions used in technical risk engineering, we propose to redefine the following terms used in wildland fire risk analysis:

Danger: Obsolete. Danger is an abstract concept based on perception. Danger per se does not exist. It is defined by subjective human and societal perceptions and assessments of events and outcomes that are considered harmful. The concept is useless for wildland fire research and management.

Hazard: A process with undesirable outcomes.

Wildland fire hazard: A wildland fire with undesirable outcomes.

Risk: The probability of an undesired event and its outcome. An undesired event is a realization of a hazard.

***Wildland fire risk**:* The probability of a wildland fire occurring at a specified location and under specific circumstances, together with its expected outcome as defined by its impacts on the objects it affects.

Wildland fire risk assessment takes into account not only the area burned, but also the value of properties, such as homes in the wildland–urban interface.

Fire Hazard. Current glossaries define the term "fire hazard" very narrowly. For example, the Canadian Interagency Forest Fire Centre's *Glossary of Forest Fire Management Terms* (CIFFC 1999) defines fire hazard as "potential fire behavior" based on "physical fuel characteristics (e.g. fuel arrangement, fuel load, condition of herbaceous vegetation, presence of ladder fuels)." In this definition, hazard is a set of fuels preconditions for wildland fire behavior.

By contrast, in the domain of technical risk engineering, hazard is more broadly defined as "a physical situation with a potential for human injury, damage to property, damage to the environment or some combination of these" (Allen 1992). The broader definition has the advantage of applicability to any process that can lead to damage. In this case, the hazard is wildland fire itself, not some subset of preconditions that might or might not lead to fire damage.

Fire Risk. The term "risk" generally has two distinct areas of meaning: (1) chance and probability; and (2) loss, harm, and injury (Landau 1999). Current wildland fire glossaries focus on the former area, neglecting the latter. For example, the United Nations Food and Agriculture Organization's *Wildfire Management Terminology* (FAO 1986) defines fire risk as "the chance of fire starting, as affected by the nature and incidence of causative agencies." This definition focuses on fire cause (the probability of ignition), ignoring fire effects (the likelihood of damage).

By contrast, in the field of technical risk engineering, risk comprises both the likelihood and the outcome of an event (Jones 1992; Gheorghe and Nicolet-Monnier 1996; Merz and others 1995). For example, Hall (1992) refers to structural fire risk as both "a measure of the expected severity (e.g., how many deaths, injuries, dollars or damage per fire)" and "a measure of the probability of occurrence." Hall's definition has the advantage of including both components of fire risk—probability and damage.

New Definitions. We base our wildland fire risk analysis and assessment on proposed new definitions:

- We drop the term "fire danger" as useless for wildland fire research and management.
- We use the term "fire hazard" as a synonym for the process of wildland fire itself.
- We make "fire risk" our central term. Specifically, we address "quantitative wildland fire risk," embedding the concept of risk in a risk management process, where risk analysis and risk assessment are important steps (Bärtsch 1998). Moreover, we use the value-free term "outcome" to describe fire effects, which are not always negative.

Quantitative Wildland Fire Risk

For a quantitative analysis, we must operationalize the term "risk" by describing the mathematical relationships between probability and outcome and by defining indicators that can be used to measure their value. Generally, risk r is defined as the product of the probability p and the expected outcome d (Jones 1992; Kumamoto and others 1996; Merz and others 1995), as follows:

$$r = p \times d \qquad (1)$$

The probability p, according to the axioms of Kolmogorov (1933), is defined for a given time period; for example, the occurrence probability of a wildland fire in the next year might be 0.8. Kolmogorov's axioms do not prescribe how probabilities are determined but define properties and calculation rules that have to be satisfied. For example, a method resulting in an index of fuel moisture with an arbitrary scale can be transformed into an ignition probability with any appropriate function. The expected outcome d is a measure or description, such as "100 acres [40 ha] of highly productive timber stands burned down" or "increased biological diversity after disturbance."

Risk deals with future events, which cannot be predicted in a deterministic way. Scenarios must be constructed to represent possible realizations of a hazard (in this case, a wildland fire). The scenarios define all relevant preconditions and causes of an event and thus enable the quantitative determination of risk.

Risk can be seen from two perspectives, subjective and collective. The subjective perspective is from a single object exposed to risk, the so-called risk acceptor. The object might be affected by many scenarios involving various types of hazards. The collective perspective is from a particular scenario, the so-called risk donor. Each scenario might affect many risk acceptors. The two perspectives both play a role in assessing risk. For example, although the collective risk might be acceptable, the subjective risk might not be, either because the damage is too great or because the probability of one object is too high. This case can occur when individual outcomes and/or probabilities are unequally distributed.

Two problems are specific to wildland fire risk analysis: spatial location and impact indicators. The first problem is identifying the location. Whereas most technical hazards have fixed locations (for example, a road or power plant), wildland fires can, in principle, start in any location covered by combustible vegetation. In assessing wildland fire risk, analysts must account for an infinite number of potential locations.

The second problem is selecting relevant impact indicators for various types of affected objects, such as timber or endangered-species habitat. Merz and others (1995) maintain that damages should, whenever possible, be quantified to permit their discussion and assessment. Taking the problems of spatial location and impact indicators into account, we define wildland fire risk as *the probability of a wildland fire occurring at a specified location and under specific circumstances, together with its expected outcome as defined by its impacts on the objects it affects*.

Wildland fire risk analysis focuses on two general areas: a fire's probability of occurrence and its outcome.

Calculating Risk

Let's apply our definition to a given study area (fig. 1) with a certain number of objects O_i and scenarios S_j. For every relation between a scenario S_j and an object O_i, the individual probability of impact e_{ij} and the individual expected impact d_{ij} at the object is calculated. The risk of a given scenario—that is, the collective wildland fire risk—is then:

$$r_j = p_j \cdot \sum_{i=1}^{n} e_{ij} \cdot d_{ij} \qquad (2)$$

Figure 2 maps the fundamental relations in the collective risk of a scenario. The collective risk is the product of probability p_j that a fire will start at a given location and expected outcome d_j. The expected outcome is a weighted sum of the impacts of the fire on all objects. This method takes into account not only the area burned, but also valuable properties, such as buildings—especially important in the wildland–urban wildland interface, where the value of burned timber is often negligible compared to the value of destroyed homes (Alexandrian 1997).

The weighting is done through the impact probability—that is, the probability that a fire will reach and affect an object. The impact probability is determined through fire spread. After the fire perimeter of a given scenario is known, an individual impact probability of 1 is assigned to all objects within the perimeter. Objects outside the perimeter have an individual impact probability of 0 and do not contribute to the sum of impacts.

In a comprehensive risk analysis, several scenarios are usually constructed to reflect all relevant cases. The risk for the whole area is then the sum of all individual scenario risks.

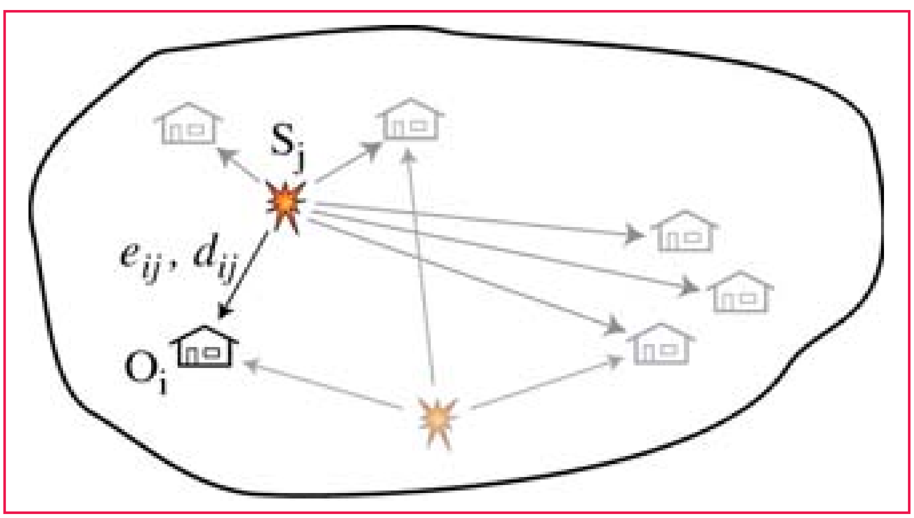

Figure 1—*Hypothetical study area showing relationships between objects and scenarios. For every relation between a scenario S_j and an object O_i, the individual probability of impact e_{ij} and the individual expected impact d_{ij} at the object can be calculated. The collective risk of the scenario can then be computed.*

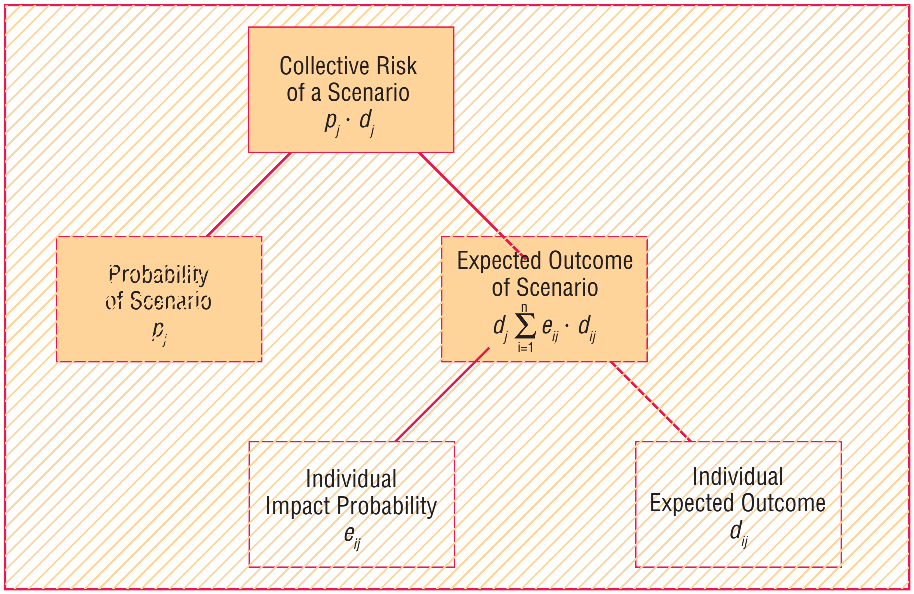

Figure 2—*Collective risk of a scenario, the product of the probability* p_j *of a fire starting at a given location, and its expected outcome* d_j. *The expected outcome is a weighted sum of the impacts of the fire on all objects. The weighting is done through the impact probability—that is, the probability that a fire will reach and affect an object.*

Research Integration

Wildland fire risk analysis focuses on two general areas: a fire's probability of occurrence and its outcome. These are the focal points for the three main wildland fire research areas: fire effects, fire behavior, and fire occurrence (fig. 3). Risk analysis can thus stimulate interdisciplinary approaches.

Probability of Occurrence. Flame depends on three factors (Pyne and others 1996): fuel, a heat source, and oxygen. Oxygen can usually be taken for granted as a constant. Fuel is the essential precondition; the heat source is the immediate cause. Fire cause and fuel conditions are the subject of fire occurrence research and fire behavior research, respectively. Because the spatial pattern of natural fire causes is very unpredictable, most fire occurrence research focuses on human activities. Fuel complex research has two main components: fuels classification and fuel moisture estimation.

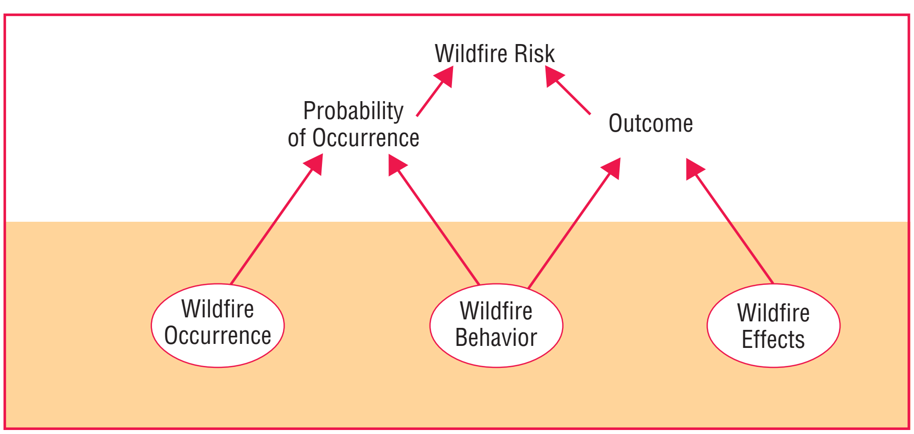

Figure 3—*Risk methodology and wildland fire research. Through its focus on fire outcome and probability of occurrence, quantitative fire risk assessment integrates each of the three major areas in wildland fire research.*

When used in wildland fire risk analysis, any approach to fire occurrence or fuels complexes should deliver a probability as a result. The probability of occurrence can be expressed as:

$$p_j = p_{ignition} \times p_{precondition} \quad (3)$$

where $p_{ignition}$ expresses the probability that any cause starts the wildland fire and $p_{precondition}$ is the probability that the fuel complex and fuel moisture permit a fire to start. The product of both probabilities assures that if one is zero, the occurrence probability will also be zero.

Outcome. The outcome of a wildland fire is determined by a weighted sum of the impacts on each affected object, with the weighting done through impact probability (eq. 2). In determining impact probability, we are especially interested in the rate of spread (Viegas and others 1998) and the ease of suppression. Accessibility, now a standard functionality in geographic information systems, can give a useful measure of suppression effectiveness, permitting the overall performance of the firefighting organization in a given region to be integrated into the risk analysis. The impact of wildland fires on objects is at the core of fire effects research, which focuses on such areas as tree mortality (Ryan 1998), erosion potential (Marxer and others 1998), and structural ignition (Cohen and others 1991). A fire's impact on an object is a function of fire behavior and the susceptibility of the object to flame.

When used in wildland fire risk analysis, all impacts must be converted into monetary terms to permit a collective comparison. Monetary conversion is often difficult for impacts such as erosion potential or destruction of natural resources such as wildlife habitat. However, economists are increasingly exploring ways to assign value to nonmarket objects (Cabán 1998).

When used in risk analysis, all impacts must be converted into monetary terms to permit a collective comparison.

An Analytical Framework

Based on the terminology presented here, Schöning and others (1997) and Bachmann and Allgöwer (1998) developed a framework for analyzing the spatial distribution of wildland fire risk using a geographic information system. In addition to scenarios and objects, "situations" are used to capture all risk-relevant parameters (fig. 4), such as weather, fuels, precipitation, and holiday activities. Situations help to group scenarios. In any given area, a wildland fire might start at an infinite number of locations. Some spatial discretization (usually rasterizing) is needed to obtain a finite number of scenarios.

Based on fire occurrence research methodology, a probability of ignition is assigned for each location in the study area, given a particular situation. The probability is then determined for each object affected under a given scenario, using appropriate fire behavior models. Finally, based on fire effects research, the amount of damage suffered by each object is estimated under each scenario. The resulting parameters are combined in a risk matrix depicting the relations among all scenarios and objects for a given situation. The matrix permits the calculation of risk characteristics pertaining to scenarios, objects, and the situation as a whole. For example, figure 5 shows the expected damage by scenario and object (buildings).

Need for a Robust Terminology

A robust wildland fire risk terminology can support a rigorous risk analysis. Risk analysis, in turn, can integrate the fields of wildland fire research, stimulating interdisciplinary work. In operational use, risk analysis can help fire managers better understand how the various aspects of fire occurrence, fire behavior, and fire effects fit together to form the totality of wildland fire.

For more information, please contact Andreas Bachmann, Geographic Information Systems Division, Department of Geography, University of Zurich, Winterthurerstr. 190, CH-8057 Zurich, Switzerland, 41-1-635-52-52 (tel.), 41-1-635-68-48 (fax), bachman@geo.unizh.ch (e-mail); or Britta Allgöwer, britta@geo.unizh.ch (e-mail).

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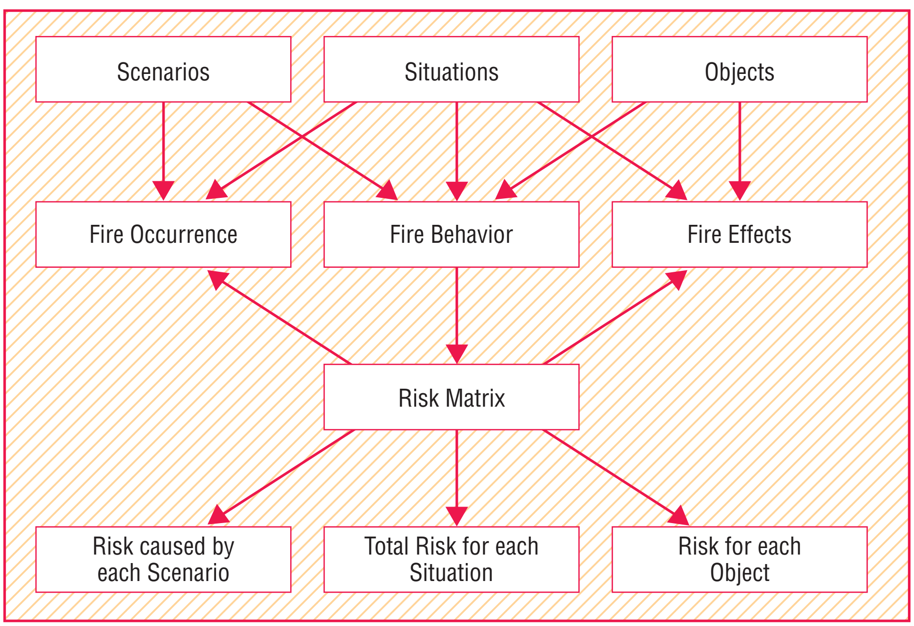

Figure 4—*Framework for a quantitative wildland fire risk analysis. Scenarios, objects, and situations capture all risk-relevant factors. Each is determined through methodologies associated with the three main areas of wildland fire research (fire occurrence, fire behavior, and fire effects). The resulting parameters are combined in a risk matrix permitting calculation of risk characteristics for scenarios, objects, and the situation as a whole.*

Risk analysis can integrate the fields of wildland fire research, stimulating interdisciplinary work.

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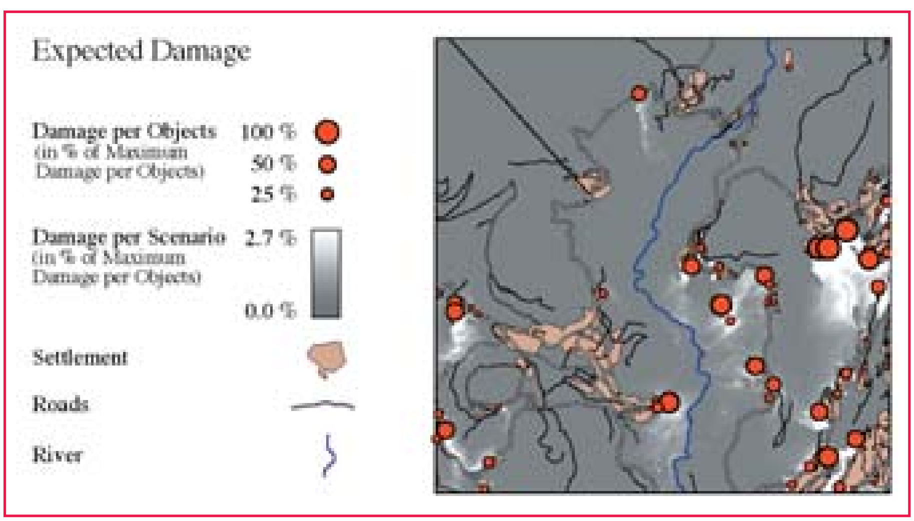

Figure 5—*Example of expected damage to objects and by scenario in Malcantone-Ticino, Switzerland, using a quantitative wildland fire risk analysis.*

Fighting the Pumpkin Fire—Indirect Attack and Aerial Ignition

Allen Farnsworth

Kendrick Mountain is a 10,400-foot (3,200-m), steep-sided cinder cone that rises dramatically more than 2,000 feet (610 m) above the surrounding Coconino Plateau in northern Arizona (fig. 1). By 2000, after nearly 100 years of fire exclusion, excessive fuel loading had primed the mountain for a devastating fire. Scientists from Northern Arizona University in Flagstaff, AZ, estimated that stand density was 10 to 15 times greater than before European settlement.

Proposals were introduced to manage fire and natural ignitions to replicate the natural nonlethal fire regime. However, because of wilderness values, threatened and endangered species, opposition to introducing managed fire into a wilderness, and a lack of funding, a fire management plan was never developed for the Kendrick Mountain Wilderness.

Fire managers used indirect attack and aerial ignition to reduce the risk to firefighters and the damage to resources in a wilderness area.

Pumpkin Fire Sizeup

On May 24, 2000, a lightning strike ignited the Pumpkin Fire (named for the nearby settlement of Pumpkin Center) 1 mile (1.6 km) southwest of the Kendrick Mountain Wilderness on the Kaibab National Forest, about 20 miles (32 km) northwest of Flagstaff. By May 25, with a 10- to 20-mile-per-hour (4–8 m/s) southwest wind blowing, the Pumpkin Fire had spread more than 5 miles (8 km) from where it had begun through ponderosa pine and mixed-conifer forest into the western portion of the Kendrick Mountain Wilderness. Fire managers soon realized that the fire would reach most of the 6,700-acre (2,700-ha) wilderness area.

The area was under extreme fire danger. On May 25, the Flagstaff National Fire Danger Rating Station recorded dead fuel moisture for 1-hour fuels at 2 percent, 10-hour fuels at 5 percent, 100-hour fuels at 5 percent, and 1,000-hour fuels at 9 percent. If the wilderness had to burn, the incident management team wanted it to be a low-intensity fire to reduce the risk to firefighters and the damage to resources. Fire managers began to develop a plan to use aerial ignition within the wilderness and to prepare an indirect fireline with mechanized equipment outside the wilderness.

The Wildland Fire Situation Analysis determined that because of extreme fire behavior, concern for firefighter safety, available firefighting resources, heavy fuels,

Figure 1—*Southeast face of Kendrick Mountain on June 3, 2000, showing cloudlike smoke plumes from the Pumpkin Fire. The mountain rises 2,000 feet (610 m) above the surrounding Coconino Plateau on the Kaibab National Forest in northern Arizona. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ, 2000.*

Allen Farnsworth is a prescribed fire specialist for the USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ.

Removing snags quickly and safely helps keep fire intensities low, with less likelihood of crowning and spotting.

difficult terrain, and weather conditions, an indirect attack posed the least risk to firefighters and had the highest probability of success. One objective that emerged from the analysis was to reduce the effect of fire in wilderness and nonwilderness areas by using low-intensity fire to secure indirect firelines. Another objective was to protect private land adjacent to the wilderness. To achieve these objectives, firefighters needed favorable aerial-ignition conditions and timber-harvesting equipment and personnel to prepare an indirect fireline for burnout operations.

Figure 2—*Night burnout (top) along a forest road following mechanical treatment to prepare indirect firelines on the Pumpkin Fire. Scorching and mortality to the residual stand (bottom) were minimal. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ, 2000.*

Fireline Preparation

A Flagstaff-based logging company, under a fire suppression contract with the USDA Forest Service, dispatched a feller/buncher, a bulldozer, two skidders, and two fallers to the Pumpkin Fire on May 26. A Forest Service timber sale administrator was the company liaison.

The first assignment for the equipment operators was to prepare the fuels next to a road on the northeast side of the fire for a burnout operation and to protect an 80-acre (32-ha) parcel of private land, with structures adjacent to the wilderness boundary. With the dense stands of ponderosa pine in the area, the feller/buncher was the best tool available to thin dense thickets along the road and private land boundary.

The two skidders piled the trees that were cut by the feller/buncher and removed downed logs and old pitchy stumps. The fireline and mechanized fuel manipulation along the private property boundary effectively kept the fire off the private land and minimized scorching and mortality to the stands of ponderosa pine and mixed conifers surrounding the private property (fig. 2). When the summer monsoon started in late June, erosion from runoff in this treated area was mitigated—an indirect benefit from the fuel manipulation.

Next, the equipment operators removed and reduced fuels along a road system on the east, south, and southwest sides of the wilderness boundary and the fire. The procedures they used had the following advantages:

> Hotshot crews that worked with the feller/buncher were enthusiastic about the performance, safety, and results.

- Feller/bunchers cut a low, inconspicuous stump;
- Trees skidded under dry-season conditions pulverized and reduced needle cast, grass, and other ground fuels;
- Skidders—mobile, fast, and less damaging than bulldozers—are useful during burnout operations for suppressing spot fires;
- Piled trees could be sold or dispersed around the burned area for erosion control or wildlife habitat;
- Hand crews could be used to pile fuels for the skidders to move outside the fireline;
- Selectively thinning the dense ponderosa pine along the fireline let the heat from the firing operation escape through openings in the canopy, reducing scorching and mortality; and
- Feller/bunchers cut hundreds of snags along the fireline faster and safer than crews could using chain saws.

Aerial Ignition

By June 3, the Pumpkin Fire had burned 12,000 acres (4,900 ha) and was well established on the west, north, and east sides of Kendrick Mountain. Fire managers decided not to allow the fire to spread on its own to the south face of Kendrick Mountain, but rather to conduct a burnout operation on the south face to manage the fire intensity there. To ensure firefighter safety and reduce resource damage, the incident management team chose an aerial ignition plan using delayed ignition devices (see sidebar). With aerial ignition, managers estimated that tree mortality would be 20 to 35 percent in the south-facing stands, compared to about 80 percent if the fire were allowed to spread on its own.

The weather forecast called for breezy daytime southwest winds, with a chance for strong southwest winds in the extended forecast. A written aerial ignition plan was developed daily that included preferred direction of travel, airspeed, number and speed of chutes for the plastic sphere dispenser, number of plastic spheres, and a map. The team flew a reconnaissance flight each day at 5 p.m. to prepare the final details for the plan, which was implemented approximately one-half hour before sunset. Several practice runs were flown during the 5 p.m. reconnaissance, with additional practice runs just before the final sunset run.

Delayed Aerial Ignition Devices

One method of ignition is by aircraft equipped with dispensers for dropping plastic spheres known as delayed aerial ignition devices. The dispenser has three chutes that the spheres are dropped into at either a slow or a fast release speed. On the ground, the spheres emit potassium permanganate injected with ethyleneglycol to create a delayed chemical thermal reaction. The resulting flame consumes the chemicals and containers, igniting surrounding fuels.

A lookout tower was on the summit of Kendrick Mountain, with a historic cabin directly below and to the east of it. Vegetation on this portion of the mountain consisted of mixed-conifer stands of spruce, limber pine, and Douglas-fir, together with small aspen stands. Ground fuels were spotty and broken up by talus slopes.

The team knew that successful firing at the top of the mountain depended on using a precise amount of fire. Too much fire would produce a high-intensity crown fire that would destroy the stands and threaten the lookout and historic cabin. The right amount of fire would carry through the stands but leave the canopy untouched. For the first several nights, aerial crews ignited only a single strip below the tower. When the fire was approximately a quarter mile (0.4 km) below the tower, four strips spaced 660 feet (200 m) apart were ignited. This action successfully generated enough fire to reduce ground fuels, with only isolated canopy torching.

Next, the team dropped one line of aerial ignition devices from the lowest point of the fire contouring across to the next lowest point on the fire in as straight a line as possible. This allowed the fire to back downslope overnight and to continue downslope into the wind the next day (fig. 3). The usual backing rate of spread over a 24-hour period is 520 to 1,320 feet (160–400 m).

The aerial ignition was completed on the evening of the June 7. The fire edge was straightened out and brought to the bottom of the slope. From this point, hand crews quickly completed the ignition to the indirect line before high winds created dangerous conditions on the afternoon of the June 8 (fig. 4).

Results

The aerial ignition and mechanized line preparation for the indirect attack succeeded. The safety record was exceptional—none of the more than 1,000 firefighters reported any serious injuries. Private property was protected and buffered from heavy erosion damage by the fuel reduction and low-intensity fires. Archeologists determined that minimal damage had occurred to the more than 100 prehistoric and historic sites in the fire suppression area. The team achieved incident objectives under severe fire weather conditions because of firefighter professionalism. Through careful planning and coordination, firefighters executed many complex tactics safely and on time.

The entire Kendrick Mountain Wilderness burned—only a few small areas were untouched by fire. The final fire perimeter encompassed 15,800 acres (6,400 ha), with 1,000 acres (400 ha) unburned within the perimeter. Fire intensities throughout the areas ignited by hand and air remained in the low-to-moderate range, with only pockets of high-intensity fire. Preliminary observations indicated that actual tree mortality was less than 20 percent on the south face of Kendrick Mountain.

The Future

The Pumpkin Fire offers considerable opportunities for fire effects research and monitoring (fig. 5). Opportunities for study, just to name a few, include aspen regeneration, long-term conifer fire

Figure 3—*South face of Kendrick Mountain after three (top), four (middle), and five (bottom) evenings of aerial ignition. Delayed aerial ignition devices were dropped from the lowest point of the fire contouring across to the next lowest point, allowing the fire to back downslope. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ, 2000.*

mortality, and postfire use of the wilderness by Mexican spotted owl. An effective monitoring program will help guide future management decisions for this and other wilderness areas. The rich opportunities for studying the Pumpkin Fire demonstrate the need for prefire baseline studies in wilderness areas to better document fire effects.

Renewed fire exclusion in the Kendrick Mountain Wilderness will only revive the vicious cycle of unnatural fuel buildups and uncharacteristic fire effects. Unless extenuating circumstances exist, future suppression of natural fires in this wilderness should not occur. Additionally, the area burned outside the wilderness should be maintained with periodic burns to buffer wilderness fires. Nature intervened in May 2000. Now, humans must develop a fire management plan to perpetuate the natural fire regime in this wilderness.

For more on the Pumpkin Fire, contact Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, 5075 N. Highway 89, Flagstaff, AZ 86004, 520-527-8227 (voice), afarnsworth @fs.fed.us (e-mail). ■

Figure 4—*Aerial and ground ignition completed. The operation was conducted safely and effectively, keeping tree mortality to less than 20 percent. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ, 2000.*

Figure 5—*Arizona fescue and bracken ferns regenerating on Kendrick Mountain 48 days after the Pumpkin Fire started. Following the fire, fire-dependent plants flourished in this fire-dependent ecosystem, offering abundant opportunities for study. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks and Mormon Lake Ranger Districts, Flagstaff, AZ, 2000.*

Critical Habitat Conserved

Burned over by the 2000 Pumpkin Fire, Kendrick Mountain in northern Arizona has four Protected Activity Centers for the Mexican spotted owl, a threatened species. In the Biological Assessment Emergency Consultation for the fire, the incident biologist wrote, "Objectives included protection of threatened species habitat to the greatest extent possible without compromising safety of the firefighters and public. This objective was met, particularly with the aerial ignition and backing fires conducted to prevent stand replacement and reduce the spread of the fire to the north, east and southerly directions."

Six National Fire Use Awards Presented for 1998 and 1999

David L. Bunnell

The national awards for wildland fire use and prescribed fire applications, established in 1995 by the USDA Forest Service Chief's Office under leadership from the Director of Fire and Aviation Management, are designed to recognize units, groups, and individuals in the Forest Service who have advanced the science, art, and/or acceptance of fire use programs for ecosystem health.* Individual awardees may receive up to $1,000 and units or groups up to $2,500. Award winners also receive an oak plaque that is laser engraved with a uniquely designed prescribed fire scene overlaid with a silver drip torch emblem.

Peer groups select the award winners based on nominations made through the regional Fire and Aviation Management directors. The 1998 and 1999 awards were presented to:

- ***Unit Awards—***
  - ***1998:*** Cherokee National Forest, Fire Management Team, Cleveland, TN;
  - ***1999:*** Francis Marion National Forest, Hurricane Hugo Fuel Treatment Team, Columbia, SC;
  - ***Program Support Award (1998)***—George Matejko, Salmon–Challis National Forest, Salmon, ID;
  - ***Group Research Award (1999)***—Steve Arno, Rocky Mountain Research Station, Missoula, MT; Steve Sackett, Pacific Southwest Research Station, Riverside, CA; and Dale Wade, Southern Research Station, Athens, GA;
- ***Individual Accomplishment Awards—***
  - ***1998:*** Paul Tiné, Superior National Forest, Grand Rapids, MN; and
  - ***1999:*** David McCandliss, Pine Ridge Ranger District, Sierra National Forest, Clovis, CA.

Dave Bunnell is the national fire use program manager, USDA Forest Service, National Interagency Fire Center, Boise, ID.

* For the full basis for the national fire use awards, see David L. Bunnell, "National Prescribed Fire Awards Recognize Excellence," *Fire Management Notes* 56(4): 12–13.

The National Fire Use Awards are bestowed annually in recognition of extraordinary contributions to the advancement of fire use for ecosystem health.

Unit Award 1998

The 1998 National Fire Use Award for unit excellence went to the fire management team on the Cherokee National Forest, Cleveland, TN. Team members are District and Zone Fire Management Officers Marty Bentley, Rex Kelley, Ronnie Lintz, Fred Locke, Roby Phillippi, Ed Stiles, Guy Street, and Bill Woody.

The team has developed and implemented an aggressive, sophisticated prescribed burning program to improve ecosystem management.

The Fire Management Team on the Cherokee National Forest, Cleveland, TN, winner of the 1998 National Fire Use Award for unit excellence. The team has developed and implemented an aggressive, sophisticated prescribed burning program to improve ecosystem management. From left are Ronnie Lintz, Rex Kelley, Guy Street, Ed Stiles, Roby Phillippi, Bill Woody, and Fred Locke. Not pictured is Marty Bentley. Photo: John Stivers, USDA Forest Service, Southern Region, Atlanta, GA, 2000.

Using both aerial and ground ignition and mobilizing support from volunteers, contractors, detailers, college students, and other forests and agencies, the team burned more than 24,000 acres (9,700 ha) on complex landscapes containing a wide variety of slopes, aspects, and elevations, with a range of timber types and age classes. This type of collaborative effort was precedent setting in the Appalachian Mountains.

Prescribed burning has become the vegetation management tool of choice to restore, maintain, and enhance strategies for fire-dependent and fire-adapted ecological communities on the Cherokee National Forest. Shortleaf, pitch, and table mountain pines, oak–hickory stands, and mixes of these types occur on more than half the forest—300,000 acres (120,000 ha). Many stands in these ecological communities are threatened by:

- Hazardous fuel buildups;
- Potential stand replacement of stable, fire-adapted species by less ecologically sustainable types;
- Native and exotic forest pests; and
- Encroachment by exotic, invasive vegetation.

The fire management officers on the forest are prime examples of innovative leadership by individuals charged with accomplishing complex management tasks. Working to ensure success through well-planned operations and partnerships, the prescribed burning program on the Cherokee National Forest achieves forest health through sound land management.

Unit Award 1999

The 1999 National Fire Use Award for unit excellence went to the Hurricane Hugo Fuel Treatment Team, Francis Marion National Forest, Columbia, SC. Team members are Rebecca Ashley, Joe Benton, Marie Butler, Olga Caballero, Steve Dix, Willie Irving, Robbie Risley, Shawn Shuler, George Stroman, Bill Twomey, William Weldon, Herman White, and Ricky Wrenn.

The Hurricane Hugo Fuel Treatment Team on the Francis Marion National Forest, Columbia, SC, winner of the 1999 National Fire Use Award for unit excellence. The team has continued a vital prescribed burning program surrounded by the devastation caused by Hurricane Hugo. From left are Herman White, Shawn Schuler, George Stroman, Marie Butler, Bill Twomey, Joe Benton, Steve Dix, Olga Caballero, and Robbie Risley. Not pictured are Rebecca Ashley, Willie Irving, William Weldon, and Ricky Wrenn. Photo: Stephanie Neal Johnson, USDA Forest Service, Southern Region, Atlanta, GA, 2000.

The team continued a comprehensive, vital prescribed burning program surrounded by the devastation caused in 1989 by Hurricane Hugo. The ambitious program is based on the team's strong belief that prescribed fire is the most effective and efficient tool available to reduce enormous fuel loads and restore fire-adapted and fire-dependent ecosystems—especially the longleaf pine ecosystem.

Hurricane Hugo caused extreme timber breakage over about 250,000 acres (100,000 ha) on the Francis Marion National Forest. The hurricane left a swath of more than 1 billion board feet of felled timber, approximately one-third of which was salvaged. The large amount of downed fuel immediately made fires difficult to control and extinguish. Since 1994, the buildup of decaying fuels has made them easy to ignite—even during periods of low fire danger. When ignited, the punky fuel releases copious amount of smoke for long periods. A complex smoke management program exists in the area's wildland–urban interface.

Fire's functional role in restoring habitat and maintaining diversity within landscapes is well understood. Periodic fire sustains the integrity of the longleaf pine and red-cockaded woodpecker habitat. On the Francis Marion National Forest, controlling rapid midstory development facilitates the recovery plan for the red-cockaded woodpecker and meets an objective of the forest plan by restoring longleaf pine.

On a landscape affected by one of the most severe disasters in recent history, employees on the Francis Marion National Forest accomplish 30,000 to 35,000 acres

(12,000–14,000 ha) of prescribed burns annually in the wildland–urban interface. The success of the program is due to the cohesion and dedication of the Hurricane Hugo Fuel Treatment Team.

> Where conditions warrant, fire use is becoming the vegetation management tool of choice for restoring ecosystem health, thanks to farsighted leadership in recent decades.

Program Support Award 1998

George Matejko, forest supervisor on the Salmon–Challis National Forest, Salmon, ID, and winner of the 1998 National Fire Use Award for program support, has provided outstanding leadership and support for the development of the forest's aggressive and sustainable fire use program. Over the past few years, Matejko has emphasized the importance of using fire as a resource management tool. Consequently, the forest's burning program increased from 4,300 acres (1,700 ha) in fiscal year (FY) 1997 to 9,700 acres (3,900 ha) in FY 1998, followed by a dramatic expansion to 29,000 acres (11,700 ha) in FY 1999.

Through progressive leadership, Matejko has restored fire as an integral part of the ecosystem in Idaho's Frank Church–River of No Return Wilderness. Recognizing that lightning-caused fires have a natural vegetative disturbance role in wilderness areas, the Forest Service has long managed some lightning-caused fires to achieve resource benefits, if the location, risks to property, public safety, weather factors, and other conditions are within prescribed limits. In 1998, Matejko promoted the management of a complex of lightning fires for wildland fire use (WFU), known as the Main Salmon Complex. The complex consisted of 16 WFU fires, which burned 21,600 acres (8,700 ha). In 1999, Matejko helped manage 13 additional WFU fires, which burned 12,700 (5,100 ha) acres, all on the Salmon–Challis National Forest. Although the use of wildland fire is difficult to plan, with outcomes that are highly weather dependent, the success of the burning program on the Salmon–Challis National Forest continues to grow under Matejko's demonstrated leadership.

Group Research Award 1999

The 1999 National Fire Use Award for group research went to Forest Service scientists Steve Arno, Rocky Mountain Research Station, Missoula, MT; Steve Sackett, Pacific Southwest Research Station, Riverside, CA; and Dale Wade, Southern Research Station, Athens, GA. Over the span of their combined careers, the three scientists have devoted about 100 years to examining various research questions related to fire and using prescribed fire in the Southeastern and Western United States. Together, they have produced more than 250 publications and 200 presentations on fire and prescribed fire. Additionally, Arno, Sackett, and Wade have devoted countless hours to training individuals and groups about prescribed fire and fuels.

Arno, Sackett, and Wade began researching prescribed burning 10 to 15 years before the Forest Service officially accepted the process in the late 1970s as a vegetation management tool. Today, through their efforts, the United

Winners of the 1999 National Fire Use Award for group research are, from left, Dale Wade, Southern Research Station, Athens, GA; Steve Sackett, Pacific Southwest Research Station, Riverside, CA; and Steve Arno, Rocky Mountain Research Station, Missoula, MT. The three Forest Service scientists have devoted a combined 100 years to research related to wildland and prescribed fire in the Southeastern and Western United States. Together, they have produced more than 250 publications and 200 presentations. Photo: Jane Rohling, National Interagency Fire Center, Boise, ID, 2000.

States uses and studies prescribed fire over extended periods at unique, long-term research sites. Research topics examined by these scientists cover all aspects of prescribed fire, including its interactions with ecosystem management, role in biological communities, and ability to mimic natural fire regimes.

Arno pioneered the development and transfer of methodologies to determine the role of fire in the evolution and maintenance of landscape-level processes and the use of fire in the restoration and maintenance of fire-dependent ecosystems. Managers and scientists routinely use his methods to determine the historical range of variation in ecosystem disturbance and to document departure from historic patterns. This information provides the basis for prescribing the frequency and severity of fire treatment necessary for restoration of ecosystem structure and function. Arno is the recognized authority in the Intermountain West on the vegetative dynamic associated with fire-dependent ecosystems. His work in developing fire history and landscape disturbance mosaic methods is the standard used by land managers and other scientists.

Sackett determined the appropriate burning interval to reduce hazardous-fuel accumulations in the palmetto–gallberry fuel complex of the lower southeastern Coastal Plain. The natural fire regime for southwestern ponderosa pine gave Sackett a starting point for researching the use of prescribed fire to reduce fuel hazards in this forest type. In recent years, he has focused on the effects of fire reintroduction into western ecosystems. To provide a comprehensive picture of the potential effects of prescribed fire, Sackett has examined the impact of prescribed fire on several different ecosystem components, including soil, plant cover and composition, nutrient cycling, smoke, and cultural resources.

Wade has conducted research in the Southern United States—principally in the southern pine ecosystems. Because prescribed burning has been widely used in the Southern United States, Wade's research has focused on understanding the various influences of prescribed fire to develop prescriptions for accomplishing a variety of ecosystem management objectives. Besides basic ecological research, he has examined the comparative costs and efficiency of prescribed fire, herbicides, and mechanical treatments. Through the efforts of Sackett and Wade, we are beginning to understand the long-term effects of repeated prescribed fire use in southern and southwestern pine systems.

Arno, Sackett, and Wade have devoted their Forest Service careers to providing support and leadership through science and education to advance the use of prescribed fire in ecosystem management. Recognized as experts in prescribed burning, these scientists have contributed to the wider and wiser

Paul Tiné, winner of the 1998 National Fire Use Award for individual accomplishment, flanked by his wife, Sherry Phillips, and by (left) Fire and Aviation Management Director José Cruz (retired) and (right) then-Acting Director Harry Croft. Tiné, a fuels specialist for the Superior National Forest, Duluth, MN, has demonstrated national leadership in developing and implementing a fire use plan for the Boundary Waters Canoe Area Wilderness in Minnesota. Photo: Dennis Neitzke, USDA Forest Service, Superior National Forest, Duluth, MN, 2000.

use of prescribed fire in the United States.

Individual Accomplishment Award 1998

The 1998 National Fire Use Award for individual accomplishment went to Paul Tiné, fuels specialist for the Superior National Forest, Duluth, MN. Tiné has demonstrated national leadership in developing and implementing a wildland fire use plan for the Boundary Waters Canoe Area Wilderness (BWCAW) in Minnesota—a national treasure of immense significance. Since 1999, Tiné has managed 45 fires for wildland fire use, treating a total of 10,000 acres (4,000 ha). Additionally, he is pursuing an amendment to the wilderness fire use plan to allow for management-ignited fire in designated wilderness areas on the National Forest System.

The BWCAW sustained a massive storm on July 4, 1999, causing blowdown of more than 30 percent of the forested area. The total area affected by the storm was more than three times the area affected by the Mount St. Helens eruption in 1980. Tiné coordinated and was responsible for a fire analysis organization, including a comprehensive fuel and fire preparedness assessment, in the blowdown and adjoining wildland–urban interface areas. He assembled a team of national experts in fuels and fire behavior, including preeminent research scientists, to provide critical baseline information and documentation for the Superior National Forest. Under his leadership, immediate action was taken to safeguard lives and property during the storm recovery work. The team's assessment will help to amend the existing fire use and preparedness plans and to restore ecosystem form and function.

Tiné demonstrated a unique ability to deal with diverse interest groups and individuals to foster collaboration and improve understanding of fire's natural role in the Lake States ecosystems. He has developed and presented various multimedia talks and shows, professional discussions, community meetings, and other public information and education programs to help the public understand that fire is a critical and integral part of many northern habitats. Tiné has been a tireless advocate for restoring fire's natural and historical role in the BWCAW ecosystem and is recognized as a foremost wildland fire use program advocate for the entire Northeast.

Individual Accomplishment Award 1999

The 1999 National Fire Use Award for individual accomplishment went to Dave McCandliss, fuels specialist for the Kings River District, Sierra National Forest, Sanger, CA. McCandliss led in developing a prescribed fire program for the forest, which had conducted no underburning during the previous decade and had a treatment target for natural fuels of only 40 acres (16 ha) per year.

In the early 1990s, episodic drought and insect mortality required extensive salvage logging in low-elevation ponderosa pine and mixed-conifer stands on the Sierra National Forest. Slash accumulations made piling ineffective or

Dave McCandliss (left) accepting the 1999 National Fire Use Award for individual accomplishment from Fire Management Officer Gary Thompson. McCandliss, a fuels specialist for the Kings River District, Sierra National Forest, Sanger, CA, helped implement a landscape-level approach to slash treatment on the forest, including prescribed fire. Photo: Dave Kohut, USDA Forest Service, Sierra National Forest, Clovis, CA, 2000.

uneconomical, and biomass use was not an option. McCandliss realized that a landscape-level approach to slash treatment was necessary in this area of highly flammable fuels adjacent to the wildland–urban interface.

Working with other district specialists, McCandliss developed and implemented a plan to underburn 6,000 acres (2,400 ha). McCandliss has also provided essential fire-related information about the 64,000-acre (25,900-ha) Kings River research study area. He has experimented with techniques and timing to restore fire cycles, reduce landscape flammability, meet increasingly restrictive air quality standards, and increase prescribed fire use to ensure ecosystem sustainability.

As McCandliss developed his personal skills and knowledge about natural fire regimes and restoring fire, he collaborated with district fire personnel, other district specialists, and Pacific Southwest researchers and scientists, sharing information and ideas. McCandliss is an excellent example of leadership in fire management programs.

Future Fire Use Program Awards

Nominations for the National Fire Use Awards are due each year on January 31. For nomination forms and information on how to nominate units, groups, or individuals for excellence in prescribed fire management, contact your regional director or Dave Bunnell, National Interagency Fire Center, 3833 South Development Avenue, Boise, ID 83705-5354; 208-387-5218 (voice); 208-387-5398 (fax); dbunnell@fs.fed.us (e-mail). ■

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Washington, DC 20090-6090
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The 1910 Fires: A New Book by Stephen J. Pyne

Hutch Brown

Next to Smokey Bear, the most familiar name in America's wildland fire organization is probably Ed Pulaski. Those who know the pulaski firefighting tool also know the man who invented it and the story that brought him fame. Pulaski's tale is the central story of the Big Blowup of 1910, an event often invoked for fireline inspiration or institutional self-validation. Pulaski's story makes us all proud.

But maybe it shouldn't. Maybe it isn't even his story, at least not one that Pulaski himself, a modest man, ever celebrated. Stephen J. Pyne's new book *Year of the Fires: The Story of the Great Fires of 1910* (Viking, 2001) makes that clear. Like all great historical writing, Pyne's book goes against the grain of history, exposing uncomfortable truths behind our founding myths. That's what makes it so valuable.

Pyne's book goes against the grain of history, exposing uncomfortable truths behind our founding myths.

A Year of Great Fires

Pyne's book is about much more than the Big Blowup. 1910 was a whole year of great fires, reaching in a vast arc from California to Washington to Minnesota. No one knows how many acres burned, but Pyne hypothesizes that 40 to 50 million (16–20 million ha) is not an unreasonable estimate. More than a million of those acres (400,000 ha) burned on August 20–21, the two days of the Big Blowup in the northern Rocky Mountains; the rest burned at other times and (mostly) in other places. Pyne writes about all the fires, moving with the fire season month by month through the year.

As usual with Pyne's books, the story unfolds in a broad context of fire ecology and social, political, and cultural history. The book contains multiple gems, such as a clear and concise explanation of fire weather. The centerpiece, of course, remains the Big Blowup; but it is only one piece in the larger puzzle of American fire history, a central subject for Pyne since *Fire in America: A Cultural History of Wildland and Rural Fire*, his seminal work in 1982.

The little-known 1910 Baudette Fire in northern Minnesota, for example, also burned more than a million acres, taking 42 lives. Comparing it to the Big Blowup, Pyne notes that the Baudette Fire—the last fire to burn more than a million acres in the Great Lakes region—signaled the end of the great "settlement fires." Settlement

"Effects of hurricane and fire in a heavy stand of white pine on the Little North Fork of the St. Joe River," Coeur d'Alene National Forest, ID. Eyewitnesses reported a "hurricane" before the 1910 Big Blowup, with winds strong enough to topple mature trees. Pyne concludes that strong winds associated with a passing front blew up smoldering fires—including backfires from previous firefighting efforts—into multiple firestorms on August 20–21. Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD (1910; 43815).

Hutch Brown is the managing editor of Fire Management Today*, USDA Forest Service, Washington Office, Washington, DC.*

Aftermath of the 1910 Big Blowup in Wallace, ID, where some 200 buildings burned. The fight to save the town is only one of many tales interwoven in Pyne's new book Year of the Fires. *Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD (1910; 43823).*

fires were associated with land clearing, farming, railroads, and other frontier and rural activities that vastly increased fuels and ignition opportunities. As agrarian conditions gave way to industrialization, opportunities for large fires faded and the great settlement fires ended.

New Firefighting Model

"If the Baudette Burn was the last million-acre burn from a century of great settlement fires," Pyne observes, "the Big Blowup was the first in a century of fire fought in wildlands." The Big Blowup blew out of the backcountry in the sparsely settled Interior West; a reason it killed at least 78 firefighters in the United States (the Canadian Rockies, Pyne points out, had no fatalities) is that the fledgling Forest Service, already steeped in the doctrine of fire control, fought to suppress every fire. The Big Blowup tested a new model of firefighting: fire control not to protect threatened towns through settler militias, but on public wildlands through backcountry fire crews. By validating their sacrifice after the fact, the Big Blowup shaped our modern understanding of wildland fires and our culture of wildland firefighting.

In telling the story, Pyne weaves an intricate tale from sources researched over many years—Forest Service records, personal letters and accounts, and U.S. Army reports by officers on fire duty. Characters pop in and out of the narrative as Pyne shifts to another topic, event, area, or crew; a list of principal characters at the beginning of the book helps the reader keep track. A continuous thread is the story of Will Morris, pieced together from personal letters that the young Forest Service employee wrote from Idaho's Coeur d'Alene National Forest—hardest hit by the Big Blowup—to his family in Chicago, IL.

Each story—Morris's, Joe Halm's, Ed Pulaski's, the Lost Crew's, and all the rest—stands on its own, yet all are interwoven in snippets that are constantly interrupted. Discursive interludes further break up the narrative, telescoping out from a firefight, for example, to its broader implications in an age of Progressive politics and Pragmatic philosophy. The weaving is deliberate and skillful. No single narrative takes center stage, as Pulaski's does for most of us today. And that is Pyne's point: The heroic narrative we know so well, the one that, over and over, has revalidated our fire control mission, is not the true story of the 1910 fires.

Fire Control Mythology

Pyne's message is that the heroic narrative that emerged from the Big Blowup is an artifact, a cultural construct created in the fires' smoldering aftermath to serve political and institutional purposes. The narrative helped make fire control central to the Forest Service's mission. The following year, a hitherto floundering Weeks Act sailed through Congress, setting the stage for the Forest Service to become the national coordinator for fire protection. The epic tale subsequently molded our view of wildland fire as an enemy to be fought in military fashion by heroes who gave their all and sometimes paid the ultimate price. Above all, it virtually decided the debate against light burning in favor of fire exclusion. It ensured that our institutional culture of fire would become, as Pyne puts it, "a culture of fire suppression."

What finally happened to Ed Pulaski? Temporarily blinded and suffering from postfire pulmonary problems, he recovered and returned to work on his ranger district. Shunning celebrity, he quietly tended the graves of those who died. We can still be proud of Pulaski—but less for his vaunted heroism than for his quiet competence, his self-effacing personal integrity, and his dedication to the land. We can be proud to support an on-the-ground tradition that nurtures such character. ■

The story unfolds
in a broad context of fire ecology
and social, political, and cultural history.

Aftermath

Editor's note: The following excerpt from the conclusion of Stephen J. Pyne's book Year of the Fires *illustrates Pyne's mastery of discursive prose.*

By the end of the twentieth century, the triumph of fire exclusion had proved as fleeting as its critics had claimed it would be. Many of the public lands suffered fire famine; forests were diseased and dying and prone to catastrophic fires. Then came that *annus horribilis*, 1994, in which thirty-four firefighters died, two million acres burned, and emergency fire costs reached a ballistic $965 million. Everyone admitted the system was broken. The policy that had boiled out of the Great Fires had, like the conflagrations themselves, at last ended its colossal run. The federal agencies sought to salvage what they could, and they intended to do so by reintroducing some species of controlled (or prescribed) burning.

Websites on Fire*

Northwest Wildland Fire Compact

The Northwest Wildland Fire Compact is an operational agreement to identify and exchange wildland fire resources among the States of Alaska, Idaho, Montana, Oregon, and Washington and the Canadian provincial and territorial agencies in Alberta, British Columbia, and the Yukon. The eight participants have developed operational guidelines and resource-sharing templates. The Compact's mission is "to facilitate the prevention, pre-suppression and control of wildland fire in the Pacific Northwest by:

- Expediting the delivery of fire control resources;
- Exploring opportunities to share fire management data and systems; and
- Cooperating in prevention programs and activities."

Website links connect to the forestry or fire management departments of each Compact member and to the Canadian Interagency Forest Fire Centre and its U.S. counterpart, the National Interagency Fire Center.

Found at <**http://www.for.gov.bc.ca/Protect/NWCompact**> ■

* Occasionally, *Fire Management Today* briefly describes Websites brought to our attention by the wildland fire community. Readers should not construe the description of these sites as in any way exhaustive or as an official endorsement by the USDA Forest Service. To have a Website described, contact the managing editor, Hutch Brown, at USDA Forest Service, 2CEN Yates, P.O. Box 96090, Washington, DC 20090-6090, 202-205-1028 (tel.), 202-205-0885 (fax), hutchbrown/wo@fs.fed.us (e-mail).

First Annual Photo Contest (Correction)

In 2000, *Fire Management Today* held its first annual photo contest. Photos in the contest were reprinted in the Fall 2000 issue (*Fire Management Today* 60(4), pages 38–41). Due to a production error, the printed images did not do justice to the original photos. The photos are reprinted here to show their high quality.

Do you have a photo that tells a story about wildland fire management? If so, turn to page 51 for instructions on how to enter our annual photo contest.

First Place, Ground Resources. *Firefighter burning out a section of fireline on the 1988 Fayette Lake Fire, Jim Bridger Wilderness, Bridger–Teton National Forest, WY. Photo: Richard Claypole, USDA Forest Service, Klamath National Forest, Happy Camp Ranger District, Happy Camp, CA, 1988.*

Honorable Mention, Wildland Fire. *Fayette Lake Fire burning in lodgepole pine at about 9,000 feet (2,700 m) near the Continental Divide on the Jim Bridger Wilderness, Bridger–Teton National Forest, WY. The fire coincided with the 1988 Yellowstone Fires. Photo: Richard Claypole, USDA Forest Service, Klamath National Forest, Happy Camp Ranger District, Happy Camp, CA, 1988.*

First Place, Prescribed Fire. *Single strip of prescribed fire under ponderosa pines on the Fort Valley Experimental Forest, Coconino National Forest, AZ. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1996.*

Second Place, Miscellaneous. *Bracken fern, one of many carpeting the forest floor 2 years after a prescribed fire on the Coconino National Forest, AZ. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1998.*

Third Place, Miscellaneous. *Historic fire lookout tree on Lindberg Hill, North Rim, Grand Canyon National Park, AZ. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1999.*

Honorable Mention, Prescribed Fire. *Strip firing under ponderosa pines on the Fort Valley Experimental Forest, Coconino National Forest, AZ. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1996.*

Honorable Mention, Prescribed Fire. *The Flagstaff Hotshots using prescribed fire to restore a travel corridor for pronghorns. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1999.*

First Place, Miscellaneous. *Lupines carpeting the floor of an open old-growth ponderosa pine forest maintained by frequent lightning fires on the Powell Plateau, North Rim, Grand Canyon National Park, AZ. Photo: Allen Farnsworth, USDA Forest Service, Coconino National Forest, Peaks Ranger District, Flagstaff, AZ, 1998.*

First Place, Aerial Resources. *A P3–A airtanker delivering retardant on the 1999 Yellow Pine Complex, Modoc National Forest, CA. Redding Hotshots (foreground) are preparing to help burn out a large section of fireline after the retardant drop. Photo: James Gould, USDA Forest Service, Klamath National Forest, Happy Camp Ranger District, Happy Camp, CA, 1999.*

Before Helicopters: Blimps for Wildland Firefighting?

Hutch Brown

Wildland fire managers have long understood the need for speed in detecting, reaching, and suppressing fires before they grow large. Beginning in 1919, the USDA Forest Service eagerly embraced a relatively new fire management tool for its speed and versatility: aircraft.

Airtankers, smokejumpers, and helicopters were still far in the future. In the early 1920s, the only feasible use for aircraft seemed to be detection. But that would change. Creative minds were already scheming to use aircraft to transport firefighters and equipment and for resupply on remote wildland fires.

One early idea was to use blimps. The blimp seemed to offer many of the advantages associated today with helicopters. According to Wallace Hutchinson (1921), an early advocate of wildland fire aviation, the blimp could:

- fly "from 25 to 50 feet of the earth as well as at several thousand feet";
- "land on a very small plot of favorable ground";
- "be held nearly stationary close to the earth";
- "discharge fire fighters by means of rope ladders"; and
- "be used for transporting supplies and fire-fighting equipment."

Hutch Brown is the managing editor of Fire Management Today, USDA Forest Service, Washington Office, Washington, DC.

During the 1920 fire season, a blimp was tested on the Angeles National Forest in California. "As a result of this trial," reported Hutchinson, "officers of the United States Forest Service are of the opinion that the blimp offers a practical solution to many of the forest fire problems in our country."

Hutchinson was wrong; blimps never saw operational use. Still, the experimentation with blimps did prefigure many helicopter uses that came much later, including supply, transportation, and even helirappeling.*

* See Michael Dudley and Gregory S. Greenhoe, "Fifty Years of Helicopter Firefighting," *Fire Management Notes* 58(4): 6–7.

Blimp tested for fire patrol on the Angeles National Forest, CA. The carriage suspended from the balloon (visible at top) could carry firefighters, supplies, and equipment. Photo: Courtesy of National Agricultural Library, Special Collections, Forest Service Photograph Collection, Beltsville, MD (W.I. Hutchinson, 1921; 156936).

Acknowledgment

The author wishes to thank Jerry Williams, a historical analyst for the USDA Forest Service, Washington Office, Washington, DC, for providing the information for this article.

Reference

Hutchinson, W. 1921. "Pony Blimps for fighting forest fires." American Forestry Magazine. October: 618–619. ■

Annual Photo Contest

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

Awards

All contestants will receive a CD–ROM with all photos not eliminated from competition. Winning photos will appear in a future issue of *Fire Management Today*. In addition, winners in each category will receive:

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

Categories

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

Rules

- The contest is open to everyone. You may submit an unlimited number of entries from any place or time; but for each photo, you must indicate only one competition category.
- Each photo must be an ***original color slide***. We are not responsible for photos lost or damaged, and photos submitted will not be returned (so make a duplicate before submission). ***Digital photos will not be accepted*** because of difficulty reproducing them in print.
- You must own the rights to the photo, and the photo must not have been published prior to submission.
- For every photo you submit, you must give a detailed caption (including, for example, name, location, and date of the fire; names of any people and/or their job descriptions; and descriptions of any vegetation and/or wildlife).
- You must complete and sign a statement granting rights to use your photo(s) to the USDA Forest Service (see sample statement below). Include your full name, agency or institutional affiliation (if any), address, and telephone number.
- Photos are eliminated from competition if they lack detailed captions; have date stamps; show unsafe firefighting practices (unless that is their express purpose); or are of low technical quality (for example, have soft focus or show camera movement). (Duplicates—including most overlays and other composites—have soft focus and will be eliminated.)
- Photos are judged by a photography professional whose decision is final.

Postmark Deadline

First Friday in March

Send submissions to:

USDA Forest Service
Fire Management Today Photo Contest
Attn: Hutch Brown, 2CEN Yates
P.O. Box 96090
Washington, DC 20090-6090

Sample Photo Release Statement

(You may copy and use this statement. It ***must be signed.***)

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

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