

*A Report by a Panel of the
National Academy of Public Administration
for the U.S. Congress and the Departments of Agriculture and the Interior*



WILDFIRE SUPPRESSION:

STRATEGIES FOR CONTAINING COSTS

September 2002



NATIONAL ACADEMY OF
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1100 New York Avenue, N.W.
Suite 1090 East
Washington, DC 20005

First published September 2002.

Printed in the United States of America

The paper used in this publication meets the minimum requirements of American national Standard for Information Sciences—permanence of Paper for Printed Library Materials, ANSI Z39.48.1984.

ISBN 1-57744-094-3

WILDFIRE SUPPRESSION: STRATEGIES FOR CONTAINING COSTS

Foreword

The cost of suppressing wildfires in the United States exceeded \$1 billion in 2000 and will do so again in 2002. And even more is being spent on other wildland fire programs. Annual National Fire Plan appropriations now surpass \$2 billion on a regular basis.

Given the congressional request, the Academy Panel focused on why wildfire suppression costs are increasing and what could be done to contain them. The Panel began its work by examining the cost-related decision-making on six large fires that burned in the summer of 2001. We found that cost-control mechanisms were in place during the management of these fires, but that some opportunities remain for improving efficiency and accountability for costs in fighting large wildfires. Accordingly, the Panel has recommended that these opportunities be pursued.

Nevertheless, the Panel concluded that the only way to significantly contain rising suppression costs is to strike at their controllable root causes. The two primary ones are the massive accumulation of hazardous fuels in the nation's wildlands and the increasing community development occurring in and near them.

The dangers continue to mount, as illustrated by the current fire season. In 2002 to date, four states set records for the largest fires in recent history, 21 firefighters lost their lives, several air tankers and helicopters crashed, thousands of homeowners evacuated, hundreds of structures were destroyed, and 6,400,000 acres burned. Without prompt and sustained action to strike at the causes of these fires, wildfire damages and costs will continue escalating.

The Academy is pleased to present this report to the Congress, the Forest Service, and the Department of the Interior. We believe the report's recommendations are practical, effective, and consistent with the President's Management Agenda, which directs Federal agencies to address the urgent management challenges facing them.

The Academy thanks the Forest Service and the Department of the Interior for the opportunity to conduct this study, and the more than 300 people—both inside and outside the government—who shared their information and views with our staff and expert Panel. Special thanks are extended to the many headquarters staff members of the two departments who facilitated our efforts, and to the persons at the six field locations where we conducted our fieldwork. All were most gracious and helpful. The Academy Panel directing this study and the project staff are to be commended for an outstanding job of synthesizing an enormously complex and challenging body of material and presenting a comprehensive set of recommendations for improving efforts to contain the rising costs of wildfire suppression.



Robert J. O'Neill, Jr.
President
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Acronyms

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
DII COE	Defense Information Infrastructure Common Operating Environment
DMA	Disaster Mitigation Act
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEA	Federal Enterprise Architecture
FEMA	Federal Emergency Management Agency
FMP	Fire Management Plan
FS	USDA Forest Service
FWS	Fish and Wildlife Service
FY	Fiscal Year
GACC	Geographic Area Coordination Center
GACG	Geographic Area Coordination Group
GIS	Geographic Information System
HAZUS	Hazards United States (a Nationwide Loss Estimation Model)
IBA	Incident Business Advisor
IC	Incident Commander
IFRCC	Interagency Fire Research Coordination Council
IMT	Incident Management Team
IQCS	Incident Qualification Certification System
I-SUITE	An Integrated Business Management Software Package
IT/IM	Information Technology/Information Management
JFSP	Joint Fire Science Program
LMP	Land Management Plan
MOU	Memorandum of Understanding
NASF	National Association of State Foresters
NEPA	National Environmental Policy Act
NFP	National Fire Plan
NMFS	National Marine Fisheries Service
NPS	National Park Service
NWCG	National Wildfire Coordinating Group
R&D	Research&Development
RAMS	Risk Assessment and Mitigation Strategies
ROSS	Resource Ordering and Status System
WFSA	Wildland Fire Situation Analysis



Panel Message

The severity and costs of wildfires are increasing across the nation, especially in the West. After remaining relatively flat through the 1970s and 1980s, the federal wildfire suppression costs trended upward sharply from the mid-1990s to today. They exceeded \$1 billion for the first time in 2000 and will do so again in 2002.

Some see the current method of paying for wildfire suppression as a blank check that removes incentives to control costs. When regular appropriations for suppressing wildfire run out for the year, the agencies borrow from trust funds and then expect these funds to be replenished at the end of the fire season with supplemental appropriations. By contrast, other wildland fire funds for reducing hazardous fuel conditions, making communities less vulnerable to wildfires, raising the preparedness of firefighters, and restoring burned areas remain under normal budget controls.

Congress, the Administration, and others are concerned about these increasing wildfire suppression costs and lack of strategies to control them. As a result of this concern in 2001, Congress asked the Forest Service (in the Department of Agriculture) and the Department of the Interior to jointly fund an independent study of how to contain wildfire suppression costs. The two departments turned to the National Academy of Public Administration to examine cost containment strategies based on six large fires that burned in 2001, three each that were managed by the Forest Service and Interior agencies. This Panel report and related background materials are the result.

The Panel is convinced that the greatest opportunities for containing suppression costs lie in building the capacity to control two of the main factors that are increasing those costs—the accumulation of hazardous fuels and the increasing exposure of human development to these hazards. The Panel recognizes that the needed large-scale hazard reduction programs in both natural ecological and community-interface settings will require sizeable

sustained investments to make a nationwide impact. But the Panel believes that the long-term value of reduced community risks and healthy ecosystems will exceed the costs of obtaining them. And some of these benefits can be obtained immediately in places where states and local communities take timely hazard mitigation and preparedness actions in combination with each other and in partnership with federal agencies. Only by reducing the accumulated hazards and making communities less vulnerable to damaging wildfires can the accelerating costs of suppression be muted.

In the past ten years, the annual average number of wildfires on all lands exceeded 80,000. Almost all of these fires were controlled early and never became the large, uncontrolled ones reported in newspapers and seen on television. But, one or two percent burned more intensely across more acres, and caused great losses of homes and other assets. This relatively small number of fires accounts for most of the increased annual suppression costs. Although highly variable from year-to-year, these costs are reaching new peaks more frequently, and the 2002 fire season is estimated to exceed the record high set in 2000. By August 2002, the states of Arizona, Colorado, New Mexico, and Oregon had already experienced the largest wildfires in recent history.

The Academy's six case studies showed that the costs of fighting large wildfires are increasing primarily because hazardous levels of fuels have accumulated on the nation's forests and rangelands at the same time that more people have been moving into homes and communities in and near these wildlands. Add in several years of severe drought, and the conditions favoring large fires rise even higher.

The Panel did find opportunities for cost savings in its case studies, but they tended to be relatively minor compared to overall suppression costs. Also, the lack of clear measurement standards made it difficult to judge the appropriateness of suppression expenditures, and this deficiency deserves attention. The Panel was disappointed,

but not surprised, that the study did not reveal opportunities for immediate and major cost savings related directly to large wildfire suppression efforts. So, nationwide wildfire suppression costs can be expected to continue rising in the short run even though efforts are made to contain them.

Based on its findings about large-fire incident management, hazardous fuels management, community vulnerability, and the departments' fire-related science and technology programs, the Panel:

- Envisions a fully integrated wildland fire program centered more on fuels management and hazard reduction in both wildlands and communities-at-risk than on suppression
- Recommends coordinated land management and fire management policies and plans with specific hazard reduction and ecological improvement goals to guide wildland fire management activities more effectively
- Strongly urges all the stakeholders to work together closely to seize opportunities for reducing hazards and containing wildfire suppression costs more effectively than they could by working separately

The federal interagency Wildland Fire Leadership Council, recommended in the Academy's December 2001 report entitled *Managing Wildland Fire: Enhancing Capacity to Implement the Federal Interagency Policy*, is now the main focal point for federal agency coordination. The current Academy Panel is calling on the Council to implement a considerable number of critical cost-containment recommendations. Therefore, the Panel believes, as suggested in the Academy's 2001 report, that it would be advantageous to support the Council with a single, unified interdisciplinary team that has permanent status, and to continue expanding the Council's membership to include agencies with responsibilities for regulatory and other processes

vital to the success of wildland fire programs.

The Panel also believes that, because the broader wildland fire problem that reaches well beyond wildfire suppression involves so many more people and jurisdictions, the solution needs to be increasingly intergovernmental. Incident management needs greater emphasis on federal, state, local, and tribal forces working together. Even more important, reducing fire hazards on wildlands and at the interface with communities needs common commitment, joint action, and effective cost sharing by all the parties. The problem is far too big to be addressed successfully with anything short of a large-scale joint effort that crosses the borders now artificially separating federal, state, local and tribal governments, and private landowners.

To implement this integrated vision, the Panel recommends four strategic initiatives that establish common goals for cost-containment and cost sharing responsibilities among the governments and other stakeholders who would benefit directly. These initiatives identify vital roles for Congress, the Wildland Fire Leadership Council, the federal agencies, and many non-federal cooperators. The strategy should build upon the wildland fire community's intergovernmental efforts over the past two years to develop a ten-year comprehensive strategy and implementation plan based on *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment* (adopted in two parts in August 2001 and May 2002 by a broad coalition of partners).

This joint effort is an important step in the right direction and would be bolstered by implementation of the Panel's recommendations. An intergovernmental approach is the only one that can produce the desired long-term results—reduced wildfire damage and controlled fire suppression costs.

Part I: Introduction and Research Results

Wildland fire suppression costs continue to grow at a rate that has increased in recent years. This study identified 30 factors affecting wildfire suppression operations and costs. Although the Panel found opportunities for additional efficiencies in managing large fires, it also found that three other factors have the greatest impact on the firefighting strategies selected and costs: a high level of fuels that feed wildfires; expanded human activities in and near the wildlands; and severe and prolonged drought. Immediate and readily available means to contain these escalating costs are not available. The best hope of containing them lie in slowing the growth of controllable wildfire hazards.

Containing wildfire suppression costs is neither a new challenge nor one that can be easily met. In the past seven years, highly-qualified groups offered more than 100 recommendations. Some recommendations have been implemented, but many have not. The main ones—related to reducing hazardous fuels, lessening community vulnerability in fire prone areas (by using fire-resistant building materials, keeping vegetation away from buildings, and keeping development out of wildlands), and raising suppression preparedness levels—require large current investments yet leave overall cost containment to be achieved in future years. No one has identified a “magic bullet” that could deliver a quick or simple solution to this problem.

In response to the severe 2000 fire season Congress enacted the National Fire Plan, a new funding process for the federal land management agencies’ fire management programs. This plan nearly doubled the agencies’ budgets for fire management, beginning in fiscal year (FY) 2001. The goal was to decrease fire suppression costs over the long term by taking a more balanced approach.

Of the \$2.9 billion appropriated for the agencies’ budgets in fiscal year 2001, approximately one-third went for increased preparedness to help keep wildfires small and controllable. Greater

preparedness provides more resources for fighting wildfires in their initial stages and protecting lives, properties, endangered species, cultural and archeological sites, and other valuable assets. Preparedness for non-federal cooperators also is enhanced by the allocation of \$136 million in the FY 2001 National Fire Plan. However, it is not sufficient to be better prepared to fight the fires. To counteract the rising costs, action must be taken to reduce fire hazards.

“In response to the severe 2000 fire season Congress enacted the National Fire Plan, a new funding process for the federal land management agencies’ fire management programs. This plan nearly doubled the agencies’ budgets for fire management, beginning in fiscal year (FY) 2001.”

The FY 2001 National Fire Plan budget allocated more than \$400 million for hazardous fuels reduction on public and adjacent lands. Many of these adjacent—and often intermingled—lands include urban and rural communities, municipal watersheds, long-distance power lines, and other vital facilities that support human activities. The firefighting community often refers to these lands as the wildland-urban interface (WUI). The Panel refers to this issue as the human interface or community interface, because many of the cases do not easily resemble “urban” or “big city” characteristics.

The nation faces a daunting hazardous fuels reduction challenge. The inventory of wildlands with unhealthy levels of hazardous fuels and ecological conditions is staggering—so large by some estimates (80 million acres) that it may take several decades to significantly reduce. The wildfire vulnerability in communities is equally challenging; one list classifies 22,000 communities as high risk.

Efforts to reduce wildland fire suppression costs are complicated by the fact that the fire management program operates within a very complex organizational environment that includes many diverse federal and non-federal stakeholders. These stakeholders have different missions, cultures, organizational structures, operating practices, expectations, jurisdictions, and powers, all of which affect program management and create major challenges to the land management agencies as they wrestle with the rising costs.

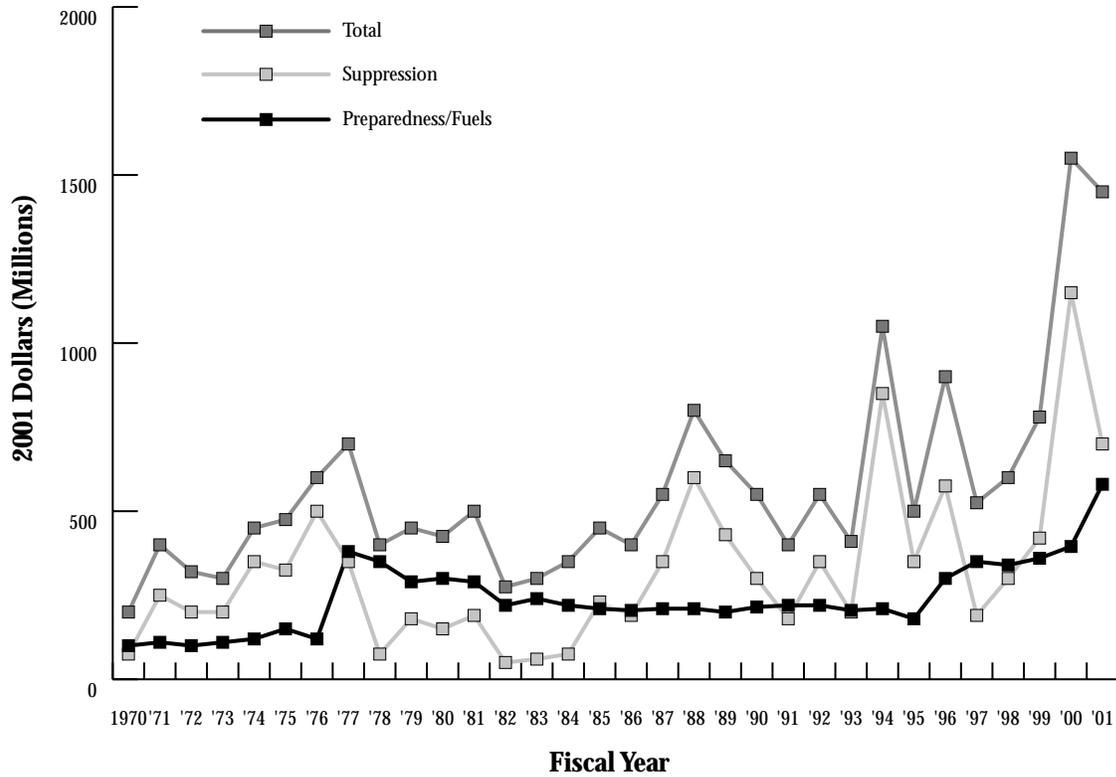
Academy staff analyzed annual Forest Service fire expenditure data from 1970 through 2001 for broad fire-related appropriations categories of Preparedness/Fuels and Suppression, as well as the total of these two categories (which does not cover such other fire-related expenditures as rehabilitation and restoration or community assistance). These data (presented in Figure 1) are inflation-adjusted to 2001 dollars, with expenditures adjusted to maintain equivalent categories throughout the entire 31-year period.

Figure 1 illustrates the inflation-adjusted Forest Service fire expenditure trends. It shows that expenditures have risen dramatically in recent years, after remaining relatively stable for many years.

Comparably formatted data for the other land management agencies are not readily available. However, the data trends reasonably reflect the total federal wildland fire program as the Forest Service has always had the largest part of the program (generally equaling or exceeding two-thirds of total budgetary resources). Chart 1 shows the current distribution of wildfire suppression expenditures among the five federal land management agencies whose programs were examined in this study.

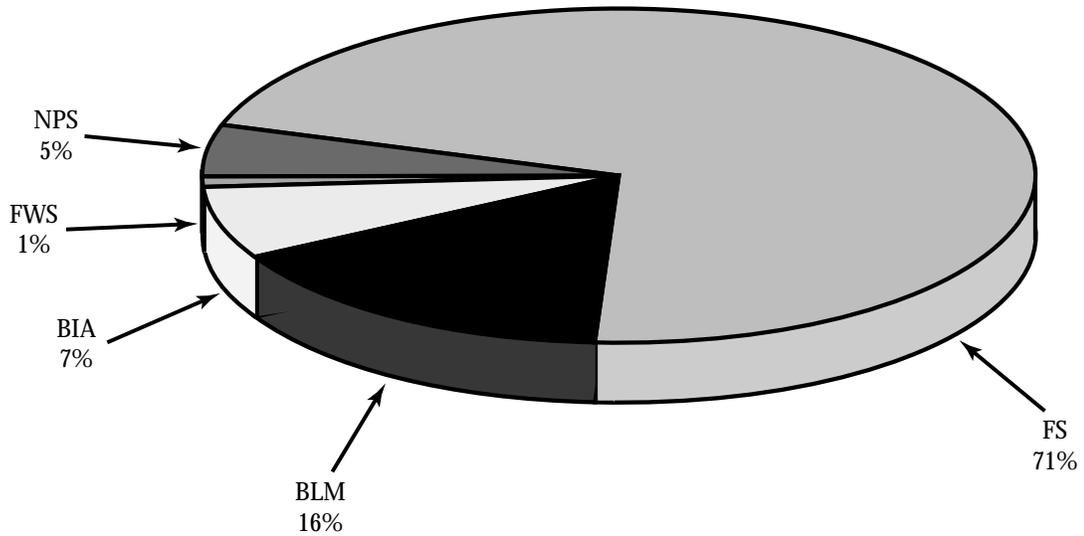
To examine potential reasons for rising suppression costs, Academy staff compared the number of fires reported on federal lands with their total acres burned and total fire expenditures for 1994 through 2001. Figure 2 shows this comparison.

**Figure 1. Forest Service Fire-Related Expenditures, 1970-2001
(Millions of Constant 2001 Dollars)**



Source: Ervin G. Schuster, David A. Cleaves, and Enoch F. Bell, *Analysis of USDA Forest Service Fire-Related Expenditures 1970-1995*. Pacific Southwest Research Station, Research Paper PSW-RP-230, March 1997. Schuster provided further updated data through 2001 to the Academy for this study.

Chart 1. Fiscal Year 2001 Suppression Expenditures for Five Agencies

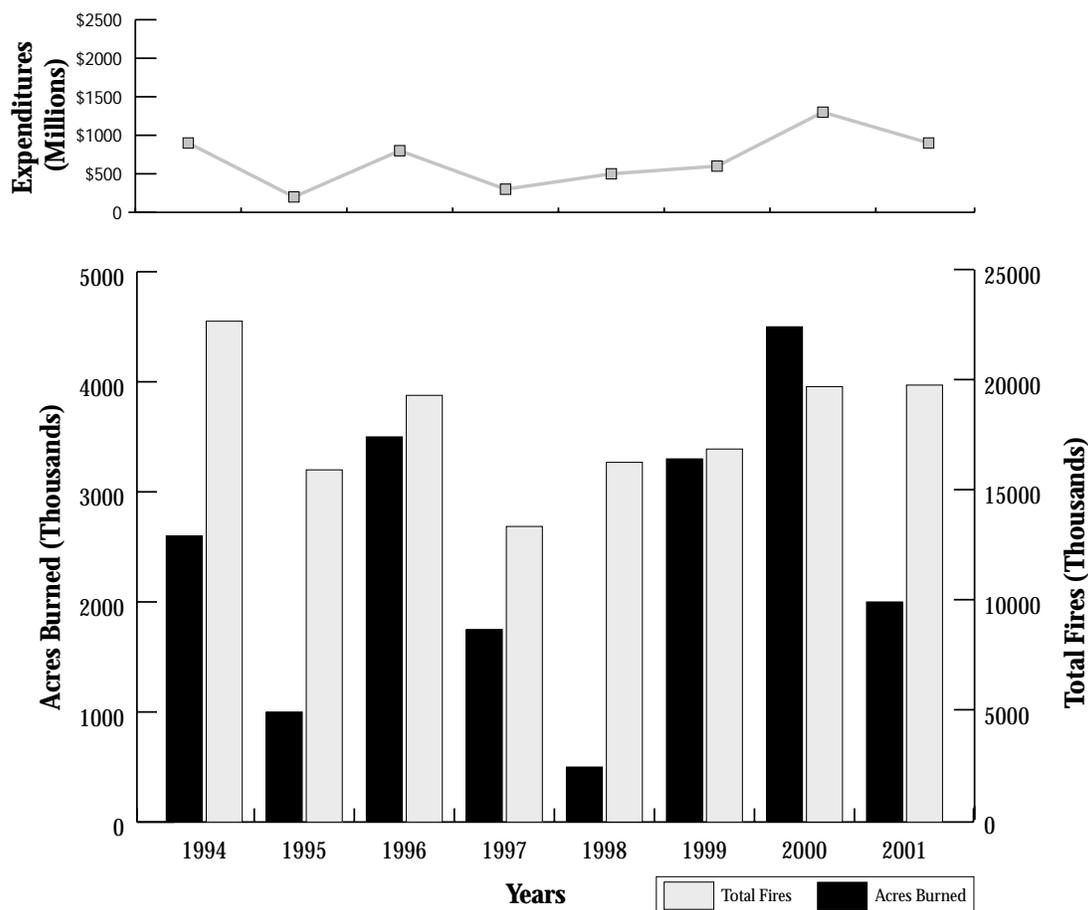


Total (in millions) \$952,695

LEGEND:
FS – Forest Service
BLM – Bureau of Land Management
BIA – Bureau of Indian Affairs
FWS – Fish and Wildlife Service
NPS – National Park Service

Source: <http://www.nifc.gov/stats>

Figure 2. Number of Fires, Acres Burned, and Federal Fire-Suppression Expenditures, 1994-2001 (Federal Agencies Only)



Source: National Interagency Fire Center Website at: <http://www.nifc.gov/stats/wildlandfirestats.html>

As Figure 2 illustrates, fire-suppression expenditures, number of fires, and acres burned generally follow the same trend (except in 1998, when acres burned decreased while fires and expenditures increased and in 2001, when the number of fires remained flat as costs and acres burned decreased). Thus, changes in fires and acres burned generally translate into expenditure changes in the same direction, though not always to the same degree. In the 2000 fire season, the number of fires and acres burned increased slightly, while total expenditures rose approximately 160 percent. These variances suggest that additional factors, beyond the number

of fires and acres burned, may influence changes in expenditures. The underlying causes of increased costs are addressed more fully later in this report.

Origin, Scope, and Methodology of the Study

Rising wildland fire suppression costs prompted Congress to ask the Forest Service and the Department of the Interior to jointly fund a “thorough, independent review of these costs and strategies.” The agencies defined the scope of the study, which called for:

- assessing fire suppression costs and their major components
- evaluating cost controls used by management
- assessing the consistency of the agencies' decisions with established policies and any barriers to improved integration among the agencies
- determining the role of scientific information as the foundation for wildland fire policies
- expert papers prepared for this study on the Wildland Fire Situation Analysis process; estimating the community and infrastructure values to be protected from damage by wildfires; and community wildfire hazard mitigation cases
- comments on various drafts of the report from Interior and Forest Service reviewers

The methodology for the study included:

- case studies of six large fires in the 2001 season—three managed by the Department of the Interior land management agencies and three by the Forest Service. The fires, which varied in size and cost, were located in five states: California, Montana, Nevada, Washington, and Wyoming. Two Academy field teams each visited three of the sites, interviewed personnel involved in managing the fires, and reviewed records. Each team included an experienced former wildfire incident commander. This report contains brief summaries of the six fires.
- interviews with more than 160 people in 13 states and the District of Columbia who represent the federal land management agencies and their wildland fire programs, plus other federal agencies; the legislative branch of the federal government; state, local and tribal governments; and private sector organizations
- an update of a 2000 survey by the National Association of State Foresters on containing the costs of suppressing large wildfires. The 2002 survey was sent to state foresters from 50 states and 7 U.S. territories. Responses were received from 105 officials in 44 states.
- review of government reports, policies, manuals, and other documents
- review of relevant literature on the topics addressed

The Academy appointed a seven-member Panel to direct and oversee the study; brief biographies of the Panel and project staff are provided in the Appendix. The Panel includes Academy Fellows and technical experts who previously served in the federal firefighting community. The Panel actively directed the work, reviewed the research results, participated in the analysis, and approved the report and its recommendations. The Panel met four times between January and August 2002.

During the study, the Academy staff maintained contact with and provided monthly progress reports to cognizant officials in the federal land management agencies, congressional committees, the Office of Management and Budget, and the General Accounting Office.

The study results are published in two volumes. The first volume is this Panel Report. The second volume will be separately published as the *Background and Research Report*, and examines in greater detail the main factors that are increasing suppression costs, including:

- the long-term build-up of hazardous fuels, combined with drought
- people's desire to live in or near wildlands despite wildfire risks
- practical means for saving money while fighting wildfires that threaten life, property, and other valuable resources

The six case studies show that current mechanisms to consider and control costs are frequently overwhelmed by policies and pressures to protect lives, homes, and many other valued assets placed at risk. Costs also may be greatly influenced by droughts. Figure 3 (on page 26)

shows how drought conditions developed during the 2001 season (the year when the case study fires burned). The drought maps can be compared with the fire outlook maps for the same period. Figure 4 (on page 27) illustrates how drought has greatly influenced the likelihood of large fires. Figure 5 (on page 28) shows the diverse human activities in and near wildlands that need to be protected. The definitions of these activities are especially important, given that they often are included in appropriations language that determines eligible expenditures.

Case Study Results

The Panel selected six fires for study from a list provided by Interior and the Forest Service of 21 of the largest 2001 fires. Selection was based on preliminary assessments of 10 fires using criteria developed by the Academy staff in consultation with the agencies. Figure 6 shows the location of the fires, and Table 1 describes their basic characteristics.

In March and April 2002, Academy field teams spent one week at each location where they reviewed the final fire package files and interviewed officials of the local land unit, incident management teams, state and local governments, and affected private landowners. In addition, environmental group representatives were interviewed at several locations. Each of the cases is summarized below according to the order in which the fires started.

The full case studies (contained in the *Background and Research Report* the background report) describe how the fires evolved and were managed, how costs were monitored, and what principal factors drove them. They assess whether agency policies were substantially followed in the decision making related to these incidents, and whether firefighting costs could have been reduced without compromising safety or firefighting effectiveness. The case studies also identify lessons learned that can be used to improve future firefighting cost-effectiveness. However, they neither include audits of detailed financial records nor make findings concerning any waste, fraud, or abuse.

Figure 6. Case Study Locations

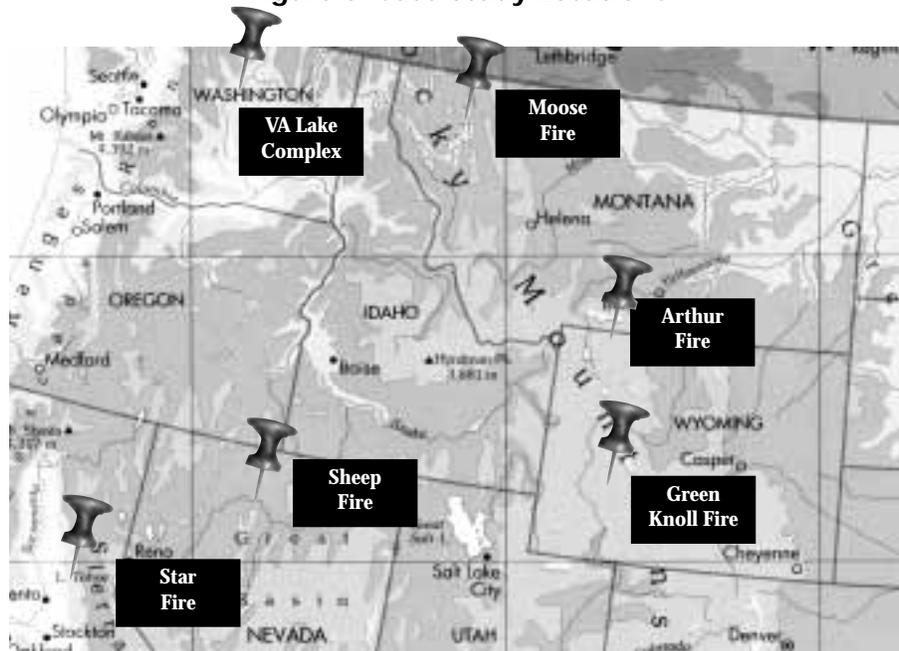


Table 1. Wildland Fire Suppression Cost Study: Six Large-Fire Cases

Characteristics of Fires	Forest Service Fires			DOI Fires		
	Moose	Star	Green Knoll	Virginia Lake	Arthur	Sheep
Acres Burned	71,000	17,500	4,470	74,243	2,800	83,673
Section Criteria						
1. Status of fire management plan	Current	Not Current	Current	Not Current	Current	Current
2. Fire managed to provide resource benefits	Partial	No	No	No	No	No
3. Wildland-Urban Interface involvement	Limited	Limited	Heavy	Heavy	Moderate	None
4. Location	Montana	California	Wyoming	Washington	Wyoming	Nevada
5. Single vs. multiple ownership	NF/NPS/ST/PVT	2NF/PVT	NF/PVT	Tribal/PVT	NPS	BLM/PVT
6. Diverse lead agencies	NF/NPS/ST/CO	2NF	NF/CO	BIA	NPS	BLM
7. Degree of local cooperation	Low	N/A	High	Low	High	Low
8. Tribal involvement	No	No	No	Yes	No	No
9. Diverse management	Yes	Yes	No	Yes	Yes	Yes
10. Predominant fuel type	Timber	Timber	Timber	Diverse	Timber	Rangeland
11. Cost per acre	\$274	\$1,611	\$2,975	\$339	\$2,142	\$26
12. Political pressures	Moderate	None	High	High	High	Moderate
13. Environmental, Cultural & Similar Issues	Moderate	Heavy	Moderate	Moderate	Low	Moderate
14. Type of Command	1 & 2	1 & 2	UC 1 & 2	1, 2, & AC	1	2
15. Pre-treated areas	No	No	No	Some	No	Some
Total Costs (Millions)	\$19.6	\$28.2	\$13.3	\$25.2	\$6.0	\$2.2

Legend

NF=National Forest
 CO=County
 ST=State
 PVT=Private
 NPS=National Park Service
 BLM=Bureau of Land Management
 BIA=Bureau of Indian Affairs
 UC=Unified Command
 AC=Area Command
 N/A=Not Applicable

Green Knoll Fire, Wyoming (Forest Service)

The Green Knoll Fire started on July 22, 2001, when a campfire escaped. It became the first large western fire of the 2001 season, burning 4,470 acres of forest within the Bridger-Teton National Forest and adjacent private lands near Jackson, Wyoming. Because the fire occurred early in the season, firefighting resources were abundantly available, and Green Knoll firefighters drew resources from across the nation. The fire cost \$13.3 million, approximately \$2,975 per acre. It was declared controlled on August 8, 2001, 17 days after it started.

The fire threatened communities, and the full case study describes in detail how protecting this interface affected the fire suppression strategy and costs. However, the most controversial issue concerned the cost-share agreement. The final agreement split the estimated costs between the Forest Service and the State of Wyoming based on ownership of the total acres burned, and split certain aviation costs equally. The state's share covered direct "structural protections," such as sprinkler systems, foam, gel, and wrapping buildings with fire shelter material, and some aviation costs. Following extended discussions, the state's cost share totaled \$2.7 million and the Forest Service paid the remainder. Little Forest Service personnel and equipment were devoted to "structural protection," but the agency made a significant effort to suppress the fire before it reached structures that were in the fire's path. The Federal Emergency Management Agency (FEMA) reimbursed the state for its \$2.7 million share.

This case illustrates the following key points:

- The fire epitomized the actions that firefighters must take to protect people and property, and the cost of doing so. Wildland fire suppression costs will continue to rise as long as more homes are located in or near the forests.

- Once a fire escapes in this environment, few opportunities exist to significantly reduce suppression costs.
- The ability to obtain needed national resources can be critical to containing a fire in a timely fashion.
- Cooperative working relationships among federal, state, and local agencies can contribute significantly to effective and efficient fire suppression operations. Especially significant in this case were the joint emergency action plans developed in advance by local firefighters and the federal agencies.
- Complete, expeditious, and responsive communications and information to area residents had great value in maintaining public confidence and support.
- Releasing costly resources in a timely manner can be accomplished without endangering firefighter or public safety.
- Previously established written guidelines on administrative, budget, and finance practices provided useful guidance to local staff, as well as to incident management teams (IMTs).
- Agency personnel need better guidance for negotiating and preparing cost-share agreements.

Notwithstanding appropriate and well-executed suppression strategy and tactics, uncontrollable factors drove Green Knoll costs to a high level compared with other large 2001 fires. Although primary emphasis was placed on structural protection on private lands, the federal government paid nearly all the costs.

Arthur Fire, Wyoming (National Park Service)

Lightning apparently started the Arthur Fire on July 28, 2001, near the top of a ridge at 9,000 feet in Yellowstone National Park, Wyoming. The fire, which burned 2,800 acres of mostly forested land, cost an estimated \$6.3 million to suppress, or \$2,142 an acre. It was contained two weeks later on August 11.

The Arthur Fire was predisposed to be costly, given weather, topography, private structures adjacent to the Park, and the need to keep it within Yellowstone's boundaries. Previously recommended fuels treatment projects had not been undertaken due to objections from Park resource managers that the projects would not adequately mimic natural events. However, the Fire occurred when fire activity was low in the Park and nationwide. Thus, the ready availability of firefighting resources and on-site fire experts helped to contain the fire within Yellowstone and avoid additional suppression costs in the adjacent community. Good relationships among the Park, the Shoshone National Forest, and the Park County Volunteer Fire Department facilitated suppression operations.

Senior Park management involvement was substantial and supportive. It endorsed decisions to close a major road into the Park and airspace above it, despite community objections. Moreover, the Park's fire management officer and assistant officer were very experienced with large wildland fires and served on the IMT assigned to manage the fire. The Park also was able to assemble a local Type 3 team to reassume management of the fire from the IMT. These constructive relationships and the Park's own firefighting capabilities made transitions of responsibility between the Park and the IMT nearly seamless and less costly than usual.

Conditions did not allow the Park to manage this fire for resource benefit purposes, but the Academy field team noted that Yellowstone's fire management plan calls for an ambitious fire-use program that results in a high number of wildland fires being managed for resource benefits.

The Arthur Fire was the only case studied where the complete I-SUITE business management software package was successfully used to track resources, prepare invoices, and produce daily management reports. Using an incident business advisor also enhanced the IMT's attention to

costs and adherence to policies, procedures, and internal controls. During demobilization, the team released aircraft and other high-cost equipment as soon as possible.

This case illustrates the following key points:

- Regardless of its level of preparedness, a land unit may not be capable of containing a fire when it is small. Arthur Fire conditions prohibited an initial attack effort and predisposed it to be a costly fire from the outset, using a large quantity of aviation resources.
- Obtaining national firefighting resources when needed can be critical to containing fires in a timely fashion.
- Land unit management's understanding of fire suppression requirements supported critical decisions—closing the road and air space—even though they adversely affected local businesses.
- Land units undertaking ambitious fire use programs must take aggressive suppression actions under certain conditions.
- Having a Type 3 IMT on the land unit can avoid the additional expense of bringing in an outside team, thereby reducing suppression costs.
- Yellowstone fire management staff's extensive experience with large wildland fires, and its ability to concentrate on this fire without being called away to other fires, greatly enhanced their ability to manage the fire.
- Different values and priorities between resource program managers and fire management staff can create obstacles to needed fuels treatments, in addition to obstacles created by external parties.

Notwithstanding appropriate and well-executed suppression strategy and tactics, uncontrollable factors drove Arthur Fire costs to a high level compared with other large 2001 fires.

Sheep Fire, Nevada (Bureau of Land Management)

The Sheep Fire started August 9, 2001, 20 miles north of Battle Mountain, Nevada. It was declared controlled five days later and burned 83,673 acres, mostly rangeland. It cost approximately \$2.2 million to suppress, or about \$26 an acre.

The Fire occurred within the boundaries of the lands managed by the Elko, Nevada Field Office. However, due to the checkerboard land ownership pattern, about half of the acreage burned was on private land in Lander County. Bureau of Land Management officials did not negotiate a cost-share agreement because they did not believe that the county could pay for suppression costs. Therefore, the federal government paid the total costs.

Four years of drought conditions in northern Nevada created rapid burning conditions. The primary fuels in the fire-affected area were sagebrush and cheat grass, which contributed to the rapid fire spread, even without constant high winds. The fire management plan called for moderate suppression techniques, but the fire management staff adopted a much more aggressive suppression strategy because of radically more severe fire seasons following the plan's development.

Initial suppression efforts were negatively affected by several key factors:

- Competition for resources was high given the large number of fires underway in the area, making aviation resources unavailable during the early stages.
- Problems with the dispatch center's communications system delayed resource allocations to the fire.
- The terrain was too dangerous for firefighters to access safely the first evening. The roads could not support fire engines.
- Contrary to normal fire behavior, the fire's growth did not slow the first night. By the time smokejumpers arrived the

following morning, the fire had grown to about 600 acres with three distinct heads caused by shifting winds.

In this fire, the risks to structures were minimal, with only a few isolated ranches and industrial plants at risk. Local ranchers were more concerned with the loss of grazing lands than with the potential loss of their homes and other structures. The Field Office also had concerns about the fire's potential negative effect on sage grouse habitat and cultural resources, such as the historic California Trail that prospectors followed during the Gold Rush. These concerns influenced the IMT to use direct attack rather than a more cost-effective indirect attack using backfires. However, this method was not successful due to burning conditions. The area eventually burned was essentially the same as it would have been had the backfire strategy been used, but the suppression and rehabilitation costs were higher.

This case illustrates the following key points:

- The inability to obtain resources in a timely fashion can be a major factor in determining whether a fire can be contained during initial attack.
- A land unit's decision not to pursue a cost-share agreement with local cooperators can place a disproportionate burden on the federal government to pay for fire costs.
- Local landowners' ability to create pressures that significantly influence strategy and tactics—and therefore costs of a fire—illustrate the need for a cooperative approach to fire management planning and suppression operations.
- Due to more severe fire seasons in recent years, land management agencies, particularly those with multiple-purpose missions, are taking more aggressive suppression actions to minimize the size of wildland fires and their impact on the land.
- Concern for firefighter safety and the value placed on protecting natural resources can increase fire costs.

Based on the Academy field team's review of available records and interviews with local officials, costs incurred appeared to be consistent with the strategy and tactics chosen for suppressing this fire.

Virginia Lake Complex, Washington (Bureau of Indian Affairs)

Lightning strikes ignited 18 fires on August 13, 2001 on the Colville Indian Reservation in eastern Washington. Two of the fires escaped initial attack and became the Virginia Lake Complex (the Complex). Four more were later added to the Complex, and the six fires burned over 74,000 acres. Suppression costs were estimated at \$25.2 million, about \$339 per acre.

Private land forms a checkerboard pattern throughout the reservation, particularly where the fires occurred. Approximately 200 privately-owned structures were at risk, and the Complex threatened several tribal resources including significant timber stands; a watershed restoration project in which the Tribe had invested about \$2 million; habitat for mule deer, whitetail deer, elk, big horn sheep, and sharptail grouse; and numerous historic, cultural, and archaeological sites. In addition to protecting structures, the Tribe's goals included protecting those resources, dictating an aggressive fire suppression strategy to minimize acres burned.

Okanogan Fire Protection District 8 was the primary local firefighting unit that responded. The relationship between district firefighters and IMT personnel was strained, and the atmosphere was tense from the outset. Eight homes burned early in the incident, and district firefighters desperately fought to avoid additional losses and to protect their livelihoods. Further, the district did not clearly understand and acquiesce to the command structure for suppression operations, and the IMTs did not establish clear procedures that outlined each party's responsibilities.

Due to the large number of ongoing fires in the region, initial attack resources were quickly drawn down and aviation resources were not readily available. Some resource scarcity continued during the IMT phase until the Complex received heightened priority for obtaining national resources. Resources then arrived so swiftly that they outpaced the Type 1 IMT Finance Section's ability to track them. When the fire was winding down, demobilization was delayed due to the lack of updated time-keeping records.

The Complex's final cost-share agreement required that the state pay for all resources ordered through the Washington State Fire Resources Mobilization Plan. Most of these were Type 1 engines used to protect structures. For the remaining resources, the Bureau of Indian Affairs paid for 95 percent of the costs and the State paid the remainder. For a fire that used significant resources to keep fires away from private structures, the percentages seem heavily weighted toward federal payment.

This case illustrates the following key points:

- Agency missions and land use goals have a large impact on firefighting objectives, as outlined in the delegation of authority, and on suppression strategies and costs.
- Difficult relationships between IMTs and local cooperators can divert the IMT's time and energy away from the primary task of suppressing the fire and can cause them to underutilize local knowledge and experience.
- The business management functions of fire suppression must keep pace with the size and complexity of the fire to ensure timely mobilization and demobilization of resources.
- Agency personnel need better guidance for negotiating and preparing cost-share agreements.

Following review of available records and interviews with local officials, the Academy field team

identified some inefficiencies with demobilizing resources and some relationship difficulties. However, the costs incurred appeared consistent with the strategy and tactics chosen for suppressing the fires.

Moose Fire, Montana (Forest Service)

On August 14, 2001, a lightning storm ignited the Moose Fire in northwestern Montana's Flathead National Forest. The fire later spread into Glacier National Park, burned more than 71,000 acres of mostly forested land over a seven-week period, and cost about \$20 million. It was the largest wildland fire on national forest lands that year and took the longest time to contain and control. Conversely, the cost per acre was only about \$275, the lowest of the Forest Service's large fires in 2001. The fire was managed by a succession of five IMTs, due largely to the 14-day limit on firefighter tenure. Some continuity was lost, and one transition encountered data transfer problems.

The Moose Fire spread over lands managed by two federal agencies (the Forest Service and National Park Service), a state forest, and private landowners. Although it occurred on lands outside the human interface, both federal and local firefighters defended isolated structures.

Flathead County's fire and emergency services provided structural fire protection on private lands, but the county refused to participate in delegations of authority or a formal unified command. Instead, it established and maintained a separate incident action plan, incident command post, and organizational structure; conducted a separate planning process; and managed a separate method for ordering resources and implementing tactics. This became the basis for the county's claim against the Forest Service for reimbursement of its expenses.

The Forest Service and National Park Service authorized different suppression strategies that impacted costs. Until the fire entered the Park, the focus was on minimizing fire size while

maintaining public and firefighter safety first, protecting property second, and pursuing resource objectives third. The Park resource staff, however, wanted to allow the fire to burn naturally as much as possible because of its location in a remote area with minimum resources at risk. In addition, the Park had direct responsibility for protecting structures on private land within its boundaries. Doing so increased fire costs by about \$200,000, but allowing the fire to burn in areas with limited risks lowered suppression costs by an undetermined amount.

This case illustrates the following key points:

- Opportunities to contain the fire during the initial attack and early development may have been lost due to delays in air support and use of inexperienced personnel.
- Management continuity could have been improved had the IMTs been allowed to stay longer than the 14 days allowed under current policy.
- Difficult and complex interaction among the local national forest land unit, the state, IMTs, and Flathead County officials illustrate the challenges of making full use of local resources in fire suppression and conducting the landscape-scale planning called for by national fire management policies and plans.

Based on the Academy field team's review of records and interviews with local officials, the costs incurred appear to be consistent with the suppression strategy and tactics chosen.

Star Fire, California (Forest Service)

On August 25, 2001, a fixed-wing reconnaissance aircraft reported a wildland fire on private lands within the Eldorado National Forest east of Sacramento. Although never confirmed, the Star Fire was assumed to be human-caused. Before it was brought under control 19 days later, the fire burned almost 17,500 acres of public and private land on two national forests—the Eldorado

and the Tahoe. The cost to suppress the Star Fire was about \$28.2 million, making it one of the most costly wildfires in 2001.

Although adequate initial attack forces were available at the fire's outset, the lack of the right resource (a Type 1 helicopter, the largest available for fighting wildfires) at the right time prevented a successful initial attack. This helicopter did not arrive until more than 10 hours after the forest initially requested one, and 5 hours after the fire significantly expanded. This delay may have been due to competition from other fires or a deficiency in communicating the need.

The three Wildland Fire Situation Analyses (WFSAs) prepared for this fire seemed to have little influence on determining strategy or controlling costs. Experienced personnel prepared the WFSAs consistent with applicable guidance, but the first one significantly underestimated the final fire size, and the second significantly overestimated the final size for the selected alternative. In addition, the strategy to suppress the fire was developed by the Type 1 Incident Commander, independent of the applicable WFA.

Star Fire never posed a threat to any human interface area. However, several factors left the forests with no option other than to aggressively suppress it. These factors included:

- the Forest Service policy requiring that all human-caused fires be suppressed
- the presence of private commercial timberlands in the Eldorado Forest
- highly valued natural resources in the Tahoe Forest, including the northernmost native population of giant Sequoia trees, old-growth sugar pine trees, rust-resistant sugar pine populations, and old-growth and wildlife values
- local expectations that the fire would be suppressed in the shortest amount of time

Concern for firefighter safety shaped suppression strategies as well as the fire's eventual size and cost. Direct fire line construction along the

fire's northeast perimeter was halted as a safety precaution after a falling tree injured a hotshot crew member. The method of suppression then shifted from primarily direct to indirect attack. For instance, it was decided to locate the fire control line some distance away from the fire's active edge, and to use a burnout to consume the fuel between them.

This case study illustrates the following key points:

- No matter how well prepared a federal land unit may be, a few unwanted fires—such as Star—will escape initial and extended attack, especially where extremely hazardous fuels exist.
- Availability of key resources is critical to a successful initial attack.
- The WFA tool, which is designed primarily to justify ordering an IMT and help select appropriate firefighting strategies, has limited value in setting meaningful cost goals or limits for such large fires as Star.
- Although a large fire may not threaten the human interface, it can be costly to suppress if other conditions, such as protection of natural resources, exist.
- Appropriate concern for firefighter safety increases fire costs.
- Once a fire overwhelms initial and extended attack and becomes large, there are few, if any, opportunities to significantly reduce management costs. For the Star Fire, nearly 25 percent of the cost was spent for aircraft, primarily Type 1 helicopters. However, neither the Academy field team nor a Forest Service regional fiscal review team found evidence to suggest that this expenditure was inappropriate.

Although there did not appear to be an opportunity to significantly reduce management costs after the fire became large, there did appear to be opportunities to improve the overall efficiency and effectiveness of the fire suppression effort. For example, a better plan for the size,

location, and infrastructure requirements of incident base locations might have saved time and reduced costs.

Other Research Results

During this study, the Academy Panel and project team pursued several other research efforts to supplement the case studies. They included interviews with or briefings by other federal agencies (including FEMA, the National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and U.S. Geological Survey) and with private organizations (the National Fire Protection Association and ESRI, a vendor of geographic information systems and services). In addition, the supplemental research included: (1) an evaluation of implementation efforts for cost-related provisions of the Federal Wildland Fire Management Policy; (2) preparation of a paper tracing the origins, evaluation, current status, and needs for improving WFSA; (3) illustrative estimates of urban values to be protected from loss due to wildfires in selected communities; (4) an updated survey of state forestry officials' views on fire-suppression cost containment; and (5) review of many previous reports, technical papers, surveys, literature, and other sources of outside research. The following sections summarize the results of these five supplemental efforts, leading to pertinent cost-related findings and conclusions.

Implementing Cost-Related Provisions of the Federal Wildland Fire Management Policy

Chapter 2 of the *Background and Research Report* describes provisions of the Federal Wildland Fire Management Policy that relate to the costs of suppressing wildland fires. It also outlines the steps taken by the five land management agencies to comply with the Policy, and efforts to develop performance measures to track implementation.

Every land unit with burnable vegetation is required to have a fire management plan (FMP)

that is closely linked to the unit's land management plan. This has become the key to implementing wildland fire policy. Together, these plans specify fire strategies that serve the overall goals of the land unit. These fire strategies identify locations where it is appropriate to adopt particular approaches to managing fires for suppression, fuels management, minimal impact on the land, or community protection purposes, and provide a basis for delegations of authority to IMTs that may be brought in to manage large fire incidents. Each of these strategies has different cost implications.

The land management agencies have communicated the need for these plans in their various policy and regulatory guidelines, but actual implementation by local land units has been incomplete and inconsistent. The recently developed interagency template for FMPs, applicable to all five agencies, builds on a two-year effort to integrate the Forest Service and National Park Service FMP guidelines. It holds the promise of fuller and more consistent implementation of this requirement. All FMPs are scheduled to be available and consistent with the new template by FY 2004. The Academy study did not include an assessment of the quality of FMPs.

Regarding property protection, the Policy considers Federal agencies as partners with wildland interface communities, and clearly defines their operational roles, including wildfire suppression, hazardous fuels reduction, cooperative prevention and education, and technical assistance. It specifically addresses structural fire protection—an issue of growing concern given the rapid growth of communities and other structures in wildland areas—and establishes the roles and responsibilities of the land management agencies *vis-à-vis* tribal, state, and local governments. This subject is covered in agency policies and guidelines, and the Academy fieldwork indicates that the Policy's intent is being met.

The Policy requires consideration of costs when determining wildland firefighting strategies, and that fires be suppressed at minimum cost

consistent with resource and safety objectives. However, firefighter safety concerns often significantly increase suppression costs. Recalling firefighters from a fire line due to dangerous weather conditions may increase the duration of the fire and raise costs. The WFS process, described in the next section, provides the only direct implementation guidance associated with these cost considerations.

However, land management agencies also authorize post-fire cost reviews, which indirectly create incentives for containing costs during fires. To implement this provision, the Forest Service authorizes national cost reviews of selected large fires that meet the following criteria: (1) incident costs were projected to exceed \$5 million; (2) a Type 1 IMT was assigned; (3) control objectives and predicted times to achieve control exceeded 5 days; and (4) there were significant natural resource concerns. Reviews of smaller Forest Service fires may be conducted at lower levels of the organization. National Park Service requires that fires be reviewed to determine firefighting strategy cost effectiveness. Bureau of Land Management mandates a state level review of fires costing \$250,000 or more, and a national level review of fires exceeding \$500,000. The Academy study team found that Forest Service cost reviews had been prepared for two of its six case studies, and became aware of at least three reviews prepared for other fires in 2001.

With respect to Policy-related performance measures, the Departments of the Interior and Agriculture have initiated efforts to create joint wildland fire performance measures. These measures concern many important Policy areas, such as information on the percentage of burnable acres covered in fire management plans, the restoration of fire-adapted ecosystems, and the reduction of hazardous fuels both inside and outside the wildland-urban interface. They also have been incorporated into the *10-Year Comprehensive Strategy and Implementation Plan*, signed in May 2002 by the Secretaries of Agriculture and the Interior, the Western

Governors' Association, the National Association of State Foresters, the National Association of Counties, the Intertribal Timber Council, and several other non-governmental organizations. This marks an effort to work collaboratively when managing wildland fire, reducing hazardous fuels, restoring habitats, and rehabilitating public land. Implementation of the joint performance measures is expected to commence by January 2003. However, they do not address the issue of cost-effectiveness as required by current policy.

The Wildland Fire Situation Analysis Process: Evolution, Status, and Need for Improvement

The WFS is a decision support process that provides an analytical method for evaluating alternative suppression strategies influenced by different fire management and cost objectives, and desired impacts on the land. It is a complex, computerized tool that has evolved since the 1970's, primarily to help land-unit managers perform the following tasks:

- Determine the type of IMT needed.
- Communicate with the IMT about how to fight the fire.
- Develop and analyze alternative strategies for managing a fire, including comparative costs and estimates of certain values to be protected.
- Select the strategy that best provides for firefighter and public safety, minimizes the total suppression costs and resource damages, and has an acceptable probability of success.
- Monitor and report on effectiveness of the selected strategy.
- Revise strategies.
- Document the fire.

In some cases, the WFS process is used in pre-fire situations to improve FMPs, train personnel to prepare WFSAs under stressful conditions, and guide firefighting preparedness exercises.

An often-heard complaint about the WFSA process concerns the pressure to complete the analysis quickly, frequently late at night, after determining that a fire is beyond local management capabilities. A related weakness stems from many federal land units' lack of experience and expertise in WFSA preparation. This is especially true for those with low fire frequency where experience with large fires is too rare to maintain WFSA proficiency. The WFSA process also treats values to be protected unevenly; some natural resources values are included directly (such as timber and grazing) while other types are not treated at all (such as residences, local businesses, public facilities, and historical properties).

Despite these problems, most land management fire staff and incident commanders support WFSA's continued use, believing that its value outweighs its challenges. The consultant paper prepared for the Panel on this topic identifies six opportunities to improve WFSA:

1. Emphasize strategic analysis.
2. Integrate WFSA more fully with fire and land management planning.
3. Enhance the role of IMTs in improving and refining a WFSA.
4. Develop standards for WFSA analysts.
5. Integrate WFSA with other decision support processes.
6. Evaluate the relationship between WFSA-aided decisions and outcomes.

The consultant paper is provided in the *Background and Research Report*.

Estimates of Urban Values to be Protected

At the Academy's request, the National Institute of Building Sciences used the nationwide Hazards United States (HAZUS) loss-estimation model, developed for the Federal Emergency Management Agency (FEMA), to estimate the principal urban values that may need to be protected from wildfire damage in ten selected moderate size communities in the five states where the Academy conducted its case studies. The estimated values are summarized in Table 2 with a total that includes public facilities, private properties, transportation, and utilities. The Institute's detailed study results are in the *Background and Research Report*.

This effort demonstrates that it is feasible to broaden the potential values to be protected, which are considered now in WFSA, beyond the limited ones for timber and other natural resources on federal lands. Such broadening is important because the purpose of the WFSA analysis is to help minimize the sum of suppression costs and potential losses. Such data also could be used to help prioritize communities for wildfire hazard mitigation.

Undoubtedly, the current HAZUS model would have to be tailored to the needs of wildland fire programs. Although, it was originally developed for use in earthquake programs, it is now being adapted for use in hurricane and flood programs, and is conceived as an all-hazards tool.

Table 2. Summary of Community Population and Value of Properties and Infrastructure at Risk

Community	Population ¹	Population ²	Total Value of Infrastructure and Private Properties (\$ in millions)
Mill Valley, CA	9,464	13,038	\$167.3
Sierra Madre, CA	15,037	10,762	\$1,726.4
Billings, MT	88,252	90,000	\$9,573.7
Missoula, MT	61,860	65,984	\$6,465.5
Elko, NV	8,439	18,400	\$3,087.5
Lake Tahoe Hwy 50 Corridor, NV	6,105		\$1,242.7
Okanogan, WA	3,730	2,484	\$1,966.5
Richland, WA	27,192	38,708	\$3,352.0
Jackson, WY	4,213	8,647	\$1,246.2
Casper, WY	52,400	49,644	\$7,226.5

Notes:

¹ 1990 Census data used for HAZUS

² Current Population based on data from community websites

Source: *Wildland Fire Exposure Study for Ten Sites in the Western U.S.*, A report prepared for NAPA by the National Institute of Building Sciences, June 2002.

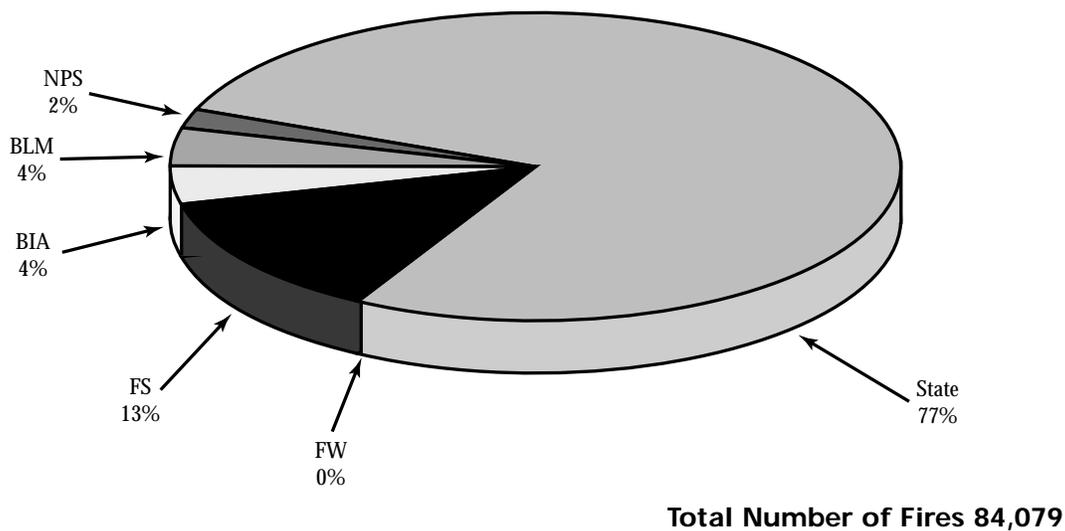
Views of State Forestry Officials on Fire-Suppression Cost Containment

In cooperation with the National Association of State Foresters (NASF), the Academy updated and expanded a two-year-old survey of state forestry officials to obtain their views on containing wildfire suppression costs. Sent to state foresters in 50 states and seven U.S. territories, the survey asked that knowledgeable staff respond. Responses were received from 105 officials in 44 states, most of which were located in the South (56), followed by the West (30), and

the Midwest/Northeast region (19). The largest numbers of respondents (65) were incident commanders or fire line officers.

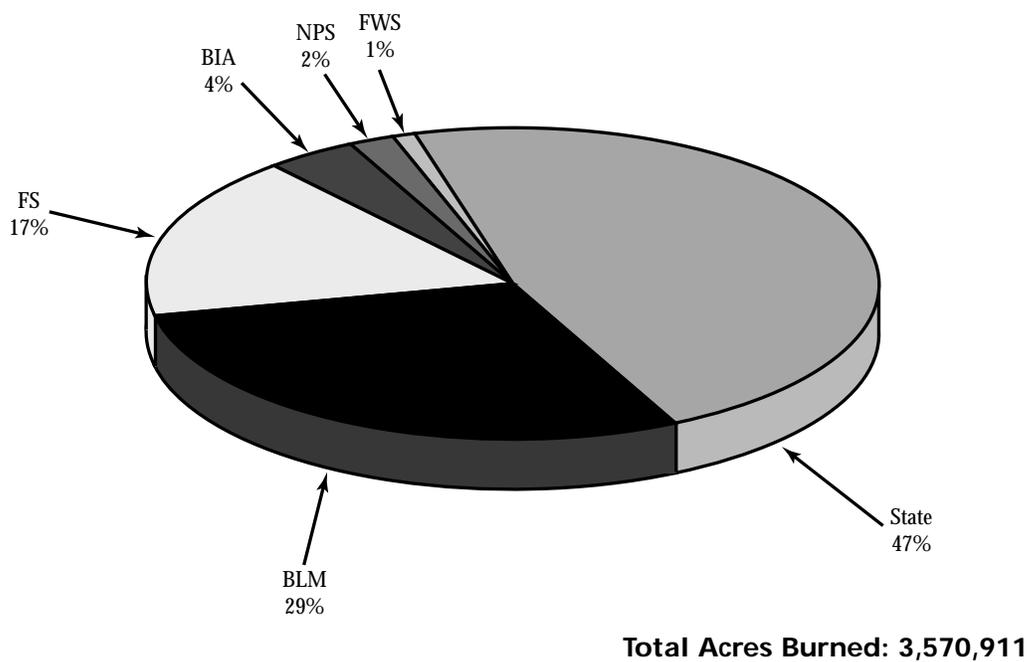
It is important to consider state views because about 77 percent of all the wildfires reported each year are under state and/or local jurisdiction—that is, they are on non-federal lands (see Chart 2). In addition, about 47 percent of the acres burned are on non-federal lands (see Chart 3). Thus, the federal and state wildland fire programs are complimentary and should be considered together.

Chart 2. Percentage of All Reported Wildland Fires, 2001



Source: <http://www.nifc.gov/stats>

Chart 3. Percentage of All Acres Burned, 2001



Source: <http://www.nifc.gov/stats>

Asked to rank the top three activities most important for reducing fire suppression costs, the respondents picked fuels management (57 percent), prevention (45 percent), and suppression practices (35 percent). Partnering with rural fire departments, pre-suppression, and other activities were viewed as less important. Most of the respondents (90 percent) reported increasing their attention to activities intended to reduce suppression costs over the past two years. Most frequently cited among these activities were fuels management, the Firewise program for educating and organizing communities to mitigate wildfire hazards, and fire prevention activities.

State respondents identified increasing costs of firefighting resources, fuels buildups, and urban sprawl as the most important factors driving suppression costs up. Concerning barriers to containing costs, the most often mentioned were lack of accountability and incentives, and difficulties getting needed firefighting resources in a timely fashion. Only 13 states reported using, or planning to use, a WFSA-type analysis for selecting firefighting strategies.

With respect to intergovernmental strategies to control suppression costs, funding for initial attack and prevention was identified as the most effective federal effort to engage the states. Joint activities and local capacity-building were seen as good approaches for engaging local governments. By a wide margin, the most important strategy for controlling suppression costs in the wildland-urban interface was education about hazard mitigation practices.

Respondents provided several suggestions concerning technologies to control fire suppression costs, but there was no consensus. Fire behavior research, weather prediction, geographic information and mapping systems, and early detection using remote sensing were all mentioned with similar frequency. Management support systems were close behind. State officials believed federal agencies could benefit most from aggressive initial attack and pre-positioning, plus efficient use of firefighting resources.

There were relatively few differences in states' responses when examined by NASF's three main regions. Perhaps the most striking difference was that zoning and other regulations to help contain suppression costs ranked second after Firewise-type educational efforts in the West and Midwest/Northeast, but fourth in the South. In all regions, however, it was rated behind the educational approach.

When compared, state and federal views (as gauged by non-survey research), were found to be similar. The most striking difference was the greater attention paid by state officials to the increasing costs of firefighting resources. These increases do not go unnoticed by federal officials, but they are seldom cited as a major factor in rising suppression costs.

Review of Others' Research

Federal and state agencies, the research and academic communities, and other organizations have focused a stream of studies and reports since 1995 on the increasing cost of suppressing large wildland fires. This body of work, along with other research and reports at the regional, local, and fire-specific levels, has generated more than 100 findings and recommendations to improve wildland fire management. Many of them are related to cost containment, efficiency, and effectiveness.

This section summarizes the past cost-related findings and recommendations made by others, and groups them under three key issues. This information is more fully documented in the *Background and Research Report*. Many of the proposals made by others address the same issues as this report. They are:

Key Policy Changes. Prior reports by others found that the forces causing increased wildland fire suppression costs greatly outweigh those that support cost savings. They proposed major changes in fire management policy to alter this balance, including:

- Clarifying priorities for containing suppression costs and protecting the wildland-urban interface
- Developing and implementing zoning regulations, fire and building codes, basic fire protection infrastructure, insurance and fire protection grading and rating systems, and fire protection agreements to make fire safety mandatory rather than voluntary
- Distributing wildland fire suppression costs among federal and non-federal agencies on the basis of the costs in an agency's area rather than on the basis of acres burned
- Tailoring the Forest Service's statutory, regulatory, and administrative framework to the new era of public land management by addressing excessive analysis; ineffective public involvement; management inefficiencies; and balancing air quality analysis to include emissions from prescribed fires and wildfires

Key Planning and Budget Changes. Prior reports by others found that the annual appropriations of limited funds among the wildland fire management activities should be better justified. Options they proposed to reduce or contain appropriations for wildland fire suppression included:

- Linking the federal agencies' cohesive fuels treatment strategy and risk assessment to an improved interagency wildland fire planning and budget process
- Expeditiously completing FMPs, consistent with national fire policy, for all burnable acres
- Recognizing costs associated with protecting non-federal lands from fires originating on federal land in the agencies' FMPs
- Incorporating non-economic factors, such as political, social, and media pressure, into the agencies' analyses to more accurately guide large-fire management decisions

- Enhancing the agencies' planning models to consider firefighting personnel and equipment potentially available from adjacent state and local jurisdictions, and combine the suppression models with those for wildland fire use and hazardous fuels reduction
- Ensuring that any decision to increase the use of non-federal personnel or equipment is based on a thorough analysis of benefits and costs

Key Changes in Managing Individual Large Wildland Fires. Prior reports by others found that the opportunities to significantly reduce the costs of managing wildland fires decline significantly once fires overwhelm initial and extended attack and become large. Nonetheless, previous reports by others have proposed restraining firefighting costs by making them a key discussion topic at every management transition point, briefing, and oversight review. Proposals included:

- Integrating risk analysis into fire management decisions
- Requiring a tradeoff or benefit/cost analysis to compare proposed restrictions on suppression tactics with any likely increase in resource damage caused by greater burned acreage
- Increasing training and mentoring to help develop the knowledge, skills, and abilities needed for cost containment and efficient management of suppression resources
- Making non-firefighting personnel available to fill support positions for fire assignments
- Revising the delegations of authority that guide IMTs to include "trigger points" that would mandate the team to initiate a meaningful least-cost alternative and cost-containment actions; a range of costs as a "cost restraint" to hold the IMT accountable for managing costs within the range; and measurable and attainable

incident goals and objectives that address environmental, social, economic, and political issues and provide insight into setting cost-effective priorities

- Assigning an Incident Business Advisor (IBA) to every large wildland fire to assist the Agency Administrator in providing proper fiscal oversight to the IMT
- Reviewing the costs of high-cost centers, such as heavy lift (Type 1) helicopters; individual large wildland fires; season-long expenditures; and long-term trends in suppression costs to provide important insights into large fire expenditures, identify trends and commonalities, derive reasons, and develop mitigations
- Developing national or regional suppression cost standards to assist IMTs in administering suppression efforts and measuring their efficiency, and establish clear and uniform fire-related job performance objectives for Agency Administrators
- Reconsidering the criteria for prioritizing fires in a multiple-fire situation to improve fire management effectiveness
- Reviewing contracting and dispatch practices to help reduce the costs of personnel and equipment
- Bolstering first-response forces by improving pre-attack planning, pre-positioned equipment and personnel, co-locating federal and state resources, interoperable communications networks, and pre-identified incident base locations
- Emphasizing the use of Type 3 IMTs for extended attack and for smaller fires to avoid ordering a Type 2 team if a fire's complexity permits the safe use of the former

The Academy Panel and staff considered these positions taken by others in developing the findings and conclusions in this report.

The Panel's Cost-Related Findings and Conclusions

Based on data analysis of the case studies and the other research described above, the Panel developed the following cost-related findings and conclusions. Related information is included in the *Background and Research Report*.

- Extreme buildups of hazardous fuels and drought conditions are likely to cause some wildland fires to escape initial and extended attack, potentially threaten communities, and generate high costs. Measures to reduce fuels buildups and protect communities provide the best way of controlling this hazard and its attendant costs.
- The costs associated with protecting non-federal lands, communities, and other resources from fires originating on federal lands can be very high. They need to be taken into consideration in the agencies' FMPs and computer planning models to provide greater assurance that adequate resources will be available for initial and extended attack and large fire management. The unavailability of the right resource at the right time can prevent a successful initial attack and impose greater suppression costs. Once a fire overwhelms initial and extended attack and becomes large, there are limited opportunities to reduce the costs of managing the fire.
- To effectively reduce vulnerability to losses from wildfires and help moderate

suppression costs in and around community interface areas, several actions can be taken to protect structures and reduce firefighting costs: fire-safety provisions in zoning ordinances, subdivision regulations, building codes, and structural and landscape maintenance regulations; basic fire-protection infrastructure in each community and mutual-aid agreements among communities, state agencies, and federal agencies; insurance and fire-protection grading and rating systems; and pre-fire reduction of fuels build-up on public and private lands near structures. Non-federal entities have responsibility for these matters but often have not used their authority for this purpose.

- Wildfire suppression costs should be shared between federal and non-federal agencies on the basis of the costs for suppression within an agency's boundaries rather than on the number of acres burned. This is because suppression costs in urban environments may be considerably higher than those in rural ones. Thus, federal land management agencies often pay a disproportionately higher share of costs when suppression costs are allocated on the basis of acres burned.
- A wildfire that does not threaten a community interface area nonetheless can be very expensive to suppress due to highly valued natural resources that require protection. Reducing fuel buildups could reduce exposure to these costs. Figure 7 (on page 29) illustrates several of these resources.
- Reducing fuel buildups requires careful planning, consultation, and environmental clearances. Using existing processes to meet these requirements often delays progress in reducing fuels and community fire hazards.

Although the factors that increased costs in the case studies overwhelmed those that reduced costs, the Panel found opportunities to improve the overall efficiency of fire suppression efforts. Capitalizing on those opportunities centered around:

- Making costs a key discussion topic at every management transition point, briefing, and oversight review. Reducing the number of transitions and improving their efficiency could help to trim costs.
- Tailoring cost-effective firefighting strategies and tactics to the many factors—and changes in them—that determine progression of a specific wildland fire. No two wildland fires are alike. Factors that vary according to fire include weather (especially drought and wind), topography (terrain), accumulation of hazardous fuels, access (roads), natural and cultural resources at risk, proximity to a community, available resources, availability and quality of data, skill levels of firefighters, and social and economic concerns. An improved WFSA process could help to enable selection of more cost-effective fire management strategies.
- Using an IBA on large wildland fires to advise the Agency Administrator, work with the IMT, and advocate cost-saving strategies is a practical avenue for considering opportunities for cost savings.
- Using modern business management software (such as I-SUITE) and automated data input devices (such as barcode and smart card technologies) can facilitate management transitions.
- Reviewing high-cost centers, such as aircraft; individual large wildland fires; season-long expenditures; and long-term trends in suppression costs that can provide important insights into large fire expenditures, identify trends and reasons, and develop recommendations for reducing future costs. Being aware that such cost reviews will take place should increase accountability for making cost-conscious decisions.
- More fully deploying appropriate communications, automation, information systems and remote sensing, and firefighting equipment technologies could make management and operations safer and more cost-effective.

Much attention has focused on the cost of wildland fire suppression, but no one is systematically assessing the benefits achieved by these expenditures, such as the protection of increased community assets at risk of damage from wildland fire. A more accurate picture of results achieved by federal expenditures would include estimates of the potential “savings” from losses prevented to homes, public buildings, public and private facilities and utilities, business facilities

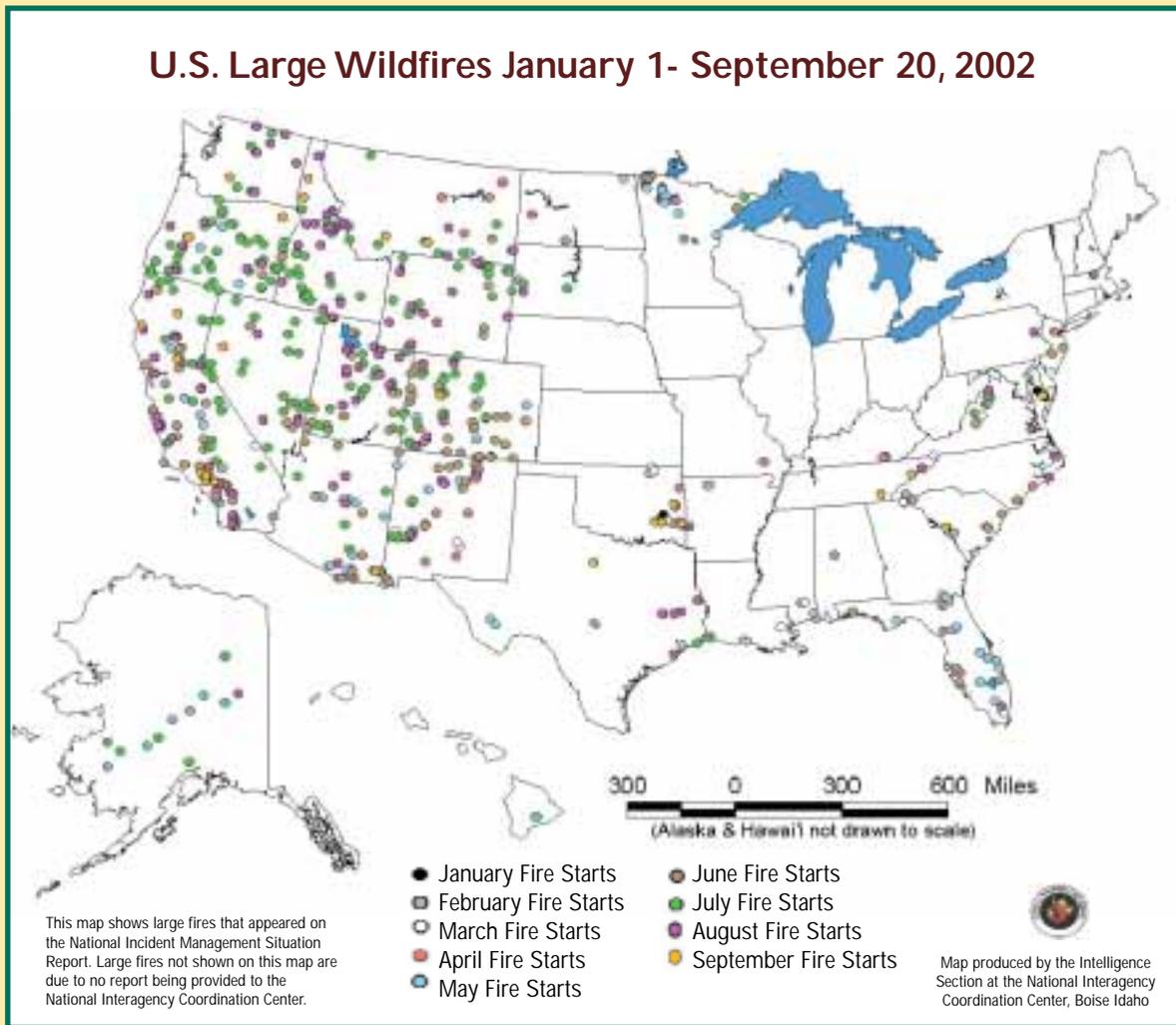
and operations, recreation, natural resources, and other assets. Estimated savings of protected federal resources alone are not adequate for measuring benefits attained by federal fire suppression programs. The estimates of urban values to be protected, prepared for this study by the National Institutes of Building Sciences, suggest one way of beginning to assess this broader range of benefits.

Illustrations

The color maps and photographs referred to in the report text have been grouped over the next eight pages. Together they provide a pictorial image of how large fires develop across the nation during the year, why they develop, and what the firefighters are trying to protect when they suppress large fires. In 2002, these large fires represented less than one percent of all reported wildfires. The other 99 percent were suppressed before they became large.

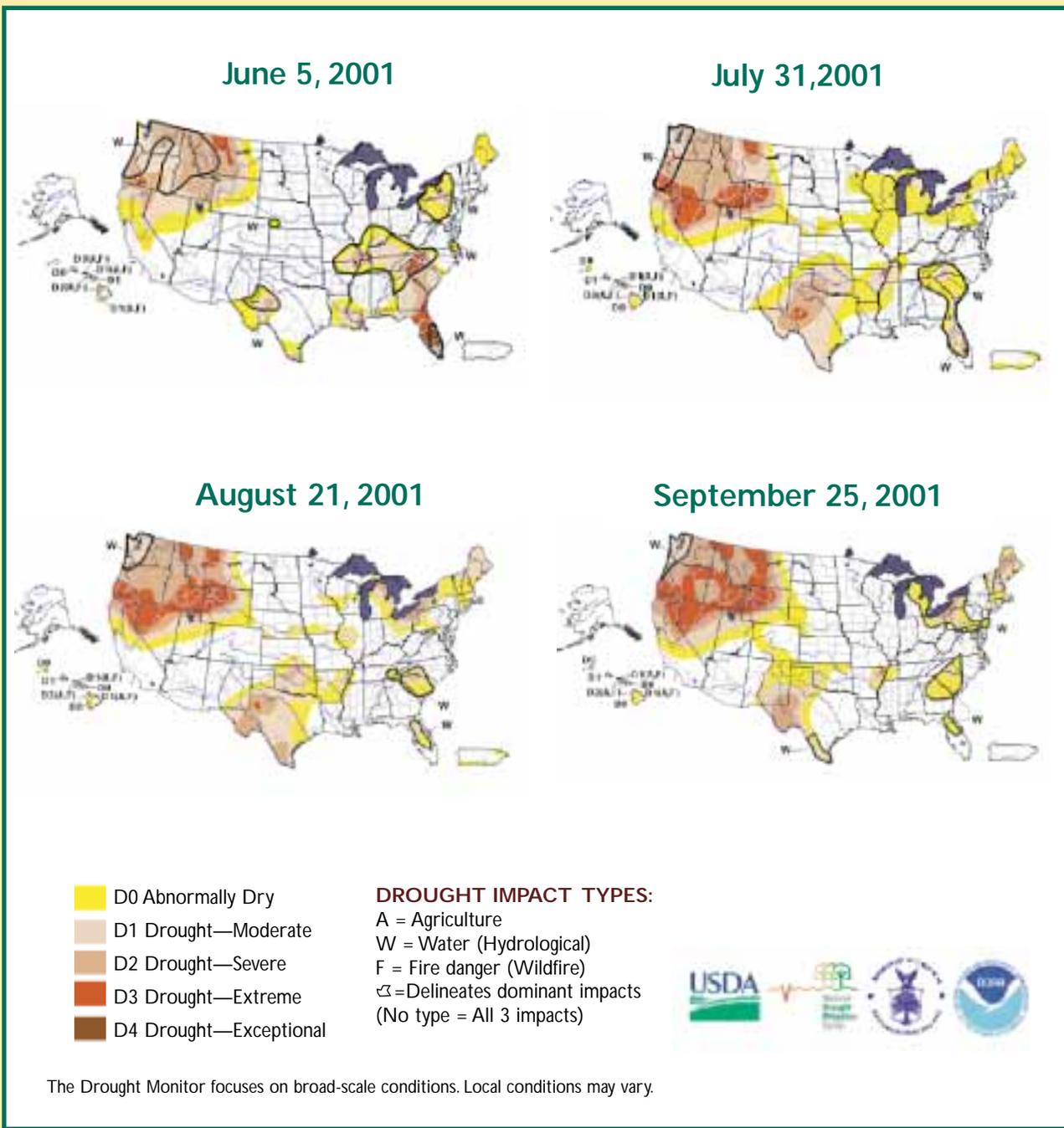
The large wildfires of 2002 occurred in different places across the nation month-by-month from January through September 2002.

Figure 11. Location of All Large Wildfires of 2002 as of September 2002



Drought is a major factor determining where large fires can be expected.

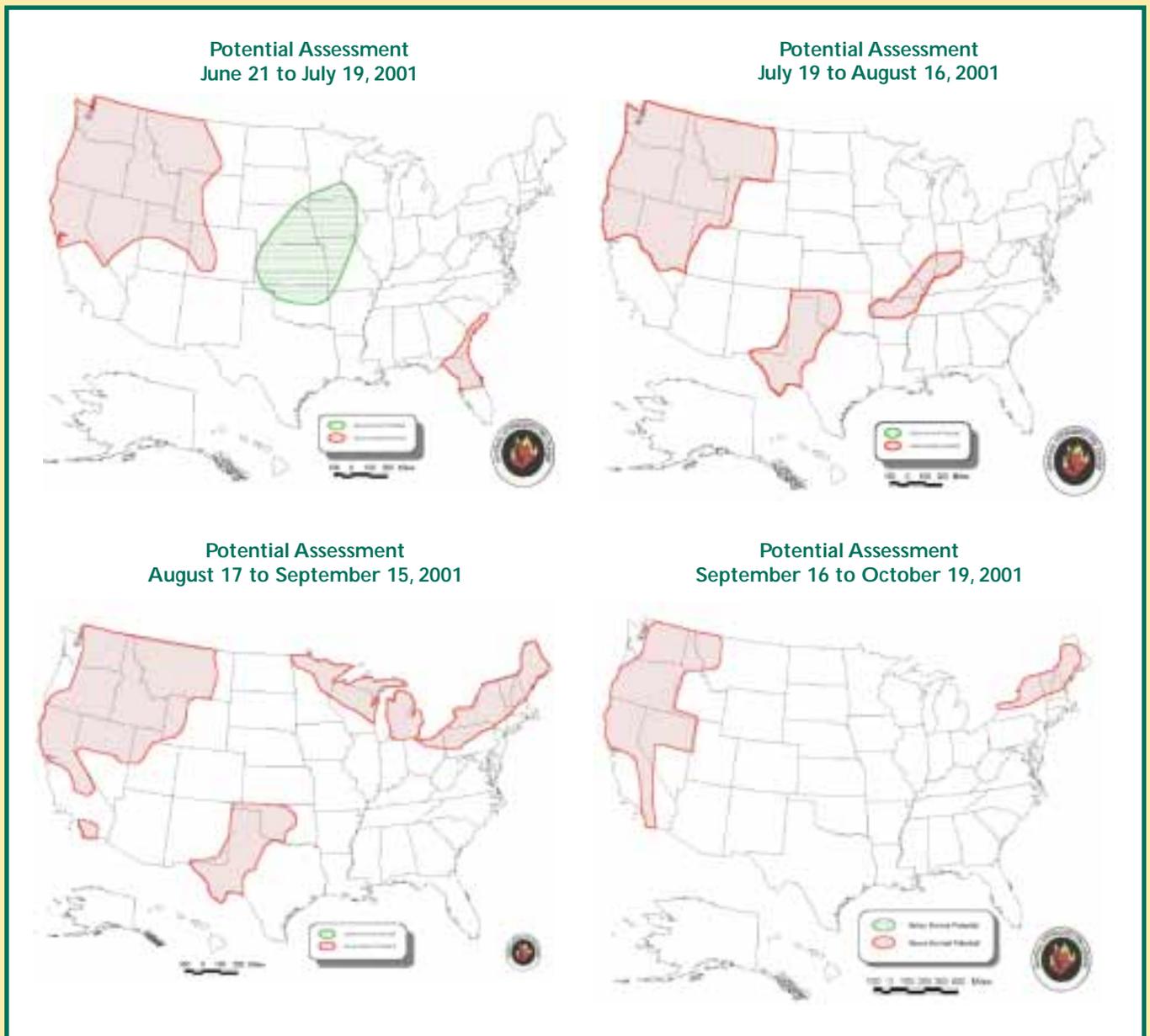
Figure 3. U.S. Drought Monitor, 2001



Source: <http://drought.unl.edu/dm/>

As drought conditions change, so do the areas where greatest wildfire activity can be expected.

Figure 4. National Wildland Fire Outlook, 2001



Source: <http://www.nifc.gov>

Firefighters are required to protect different types of human-created values.

Figure 5. Community Resources To Be Protected from Wildfire



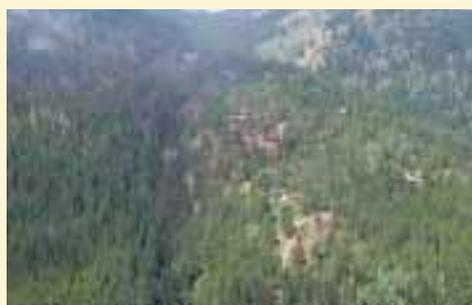
Fire Approaching Urban Community



Municipal Watershed



Suburban Wildfire Burn-Over



Rural Subdivision in Fire-Prone Wooded Area



Isolated Rural Residence



Isolated Telecommunication Structure



Telecommunication and Power Lines on Federal Wildland



Cultural/Historic Values

Firefighters also are required to protect many different types of natural resources.

Figure 7. Natural Resource Values To Be Protected



Grassland



Timber



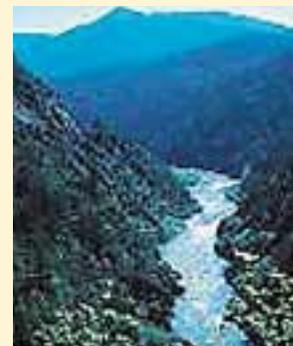
Nesting Threatened Species



Recreation



Threatened Species Habitat

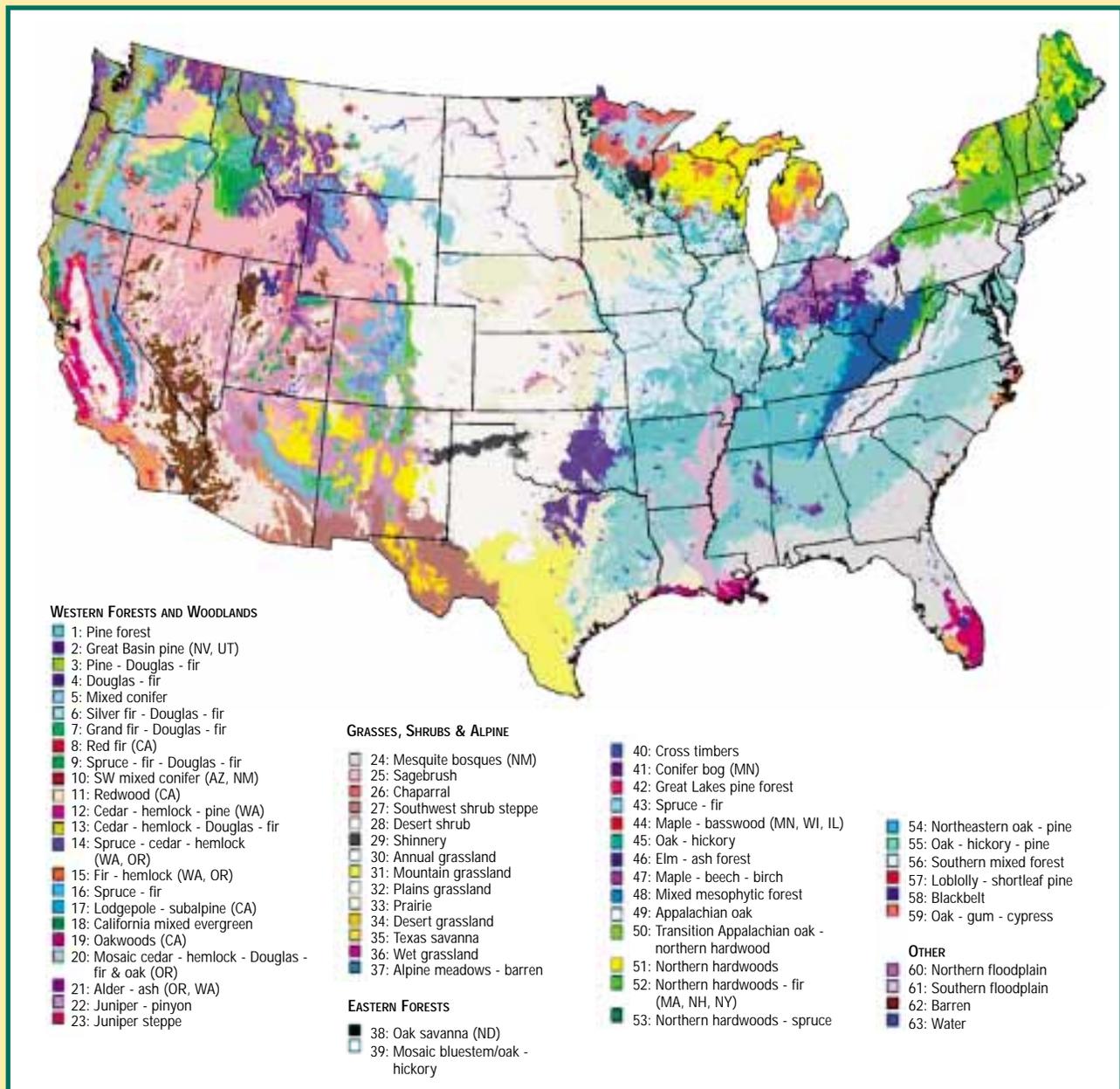


Riparian

Source: Grassland, NIFC Image Portal (<http://142.163.108.157/nifc/index.html>); Timber, NIFC Image Portal, Bryan Day; Nesting, Larry Ridenhou, BLM; NIFC Image Portal; Threatened Species Habitat, Yellowstone, National Park Service; Riparian, Kalmath River Riparian, FWS

The role and frequency of fire in maintaining healthy and relatively non-hazardous wildlands differs in major ways among areas dominated by different types of vegetation. The various types of vegetation are unevenly distributed across the nation.

Figure 8. Natural Vegetation Groups



Source: USDA Forest Service General Technical Report RMRS-GTR-87. 2002.

The condition of vegetation in the fire regimes is also a significant predictor of fire hazards.

Figure 9. Fire Condition Classes

Fire Condition Class 1 – Low Risk

Ecosystems in this fire class are mainly within their historical fire regimes. Fires within those ecosystems generally pose little risk and have a positive impact on the biodiversity as well as soil and water quality. However, there is a need for maintenance management in order to prevent those lands from degradation. Such maintenance can be achieved by fire use methods.



Open ponderosa pine stand maintained by frequent, low-severity fire, is dominated by large trees. Stand is resilient to disturbances such as insects and disease outbreaks.



Wyoming big sagebrush type with considerable diversity is generally more resilient to disturbance and provides habitat for a great number of species.

Fire Condition Class 2 – Moderate Risk

The risk of losing key ecological components due to occurrence of fire is moderate in this class. The fire regimes have been moderately altered from their historical range by decreased fire frequency, resulting in excessive accumulation of understory vegetation. If not treated, those fuel buildups might result in more intense fires that are more difficult and costly to suppress, and have negative impact on biodiversity as well as water and soil quality. Thus, fuel treatments, such as fire use or thinning, are needed to restore the original condition of these lands and reduce the risks of destructive wildland fires.



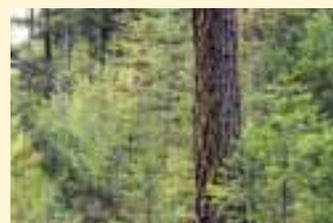
Selective logging in ponderosa pine stands progressively removed the larger trees. Without periodic fire, forest openings filled with thickets of smaller understory trees.



Wyoming big sagebrush type where fire has been excluded for an extended period has reduced diversity and provides habitat for fewer species. The site is also vulnerable to future cheatgrass invasion and to wildland fire.

Fire Condition Class 3 – High Risk

Fire regimes have been significantly altered from their historical range, resulting in high risk of losing key ecosystem components if fire occurs. Fire return intervals have been increased or decreased by multiples, leading to dramatic changes in landscape patterns. Excessive accumulation of dead vegetation and large quantities of small trees that grow densely among the larger ones can lead to severe, high-intensity wildland fires. Within this class, characteristic for short-interval fire-adapted ecosystems, wildland fires damage not only all trees but also can lead to serious soil erosion and water contamination. Fire use methods should be used cautiously in those areas; prescribed burning should be done after mechanical or hand treatments.



The dense thickets of understory trees eventually become sufficiently large to allow fire spread into the ponderosa pine crowns. These thickets are also highly drought-prone.

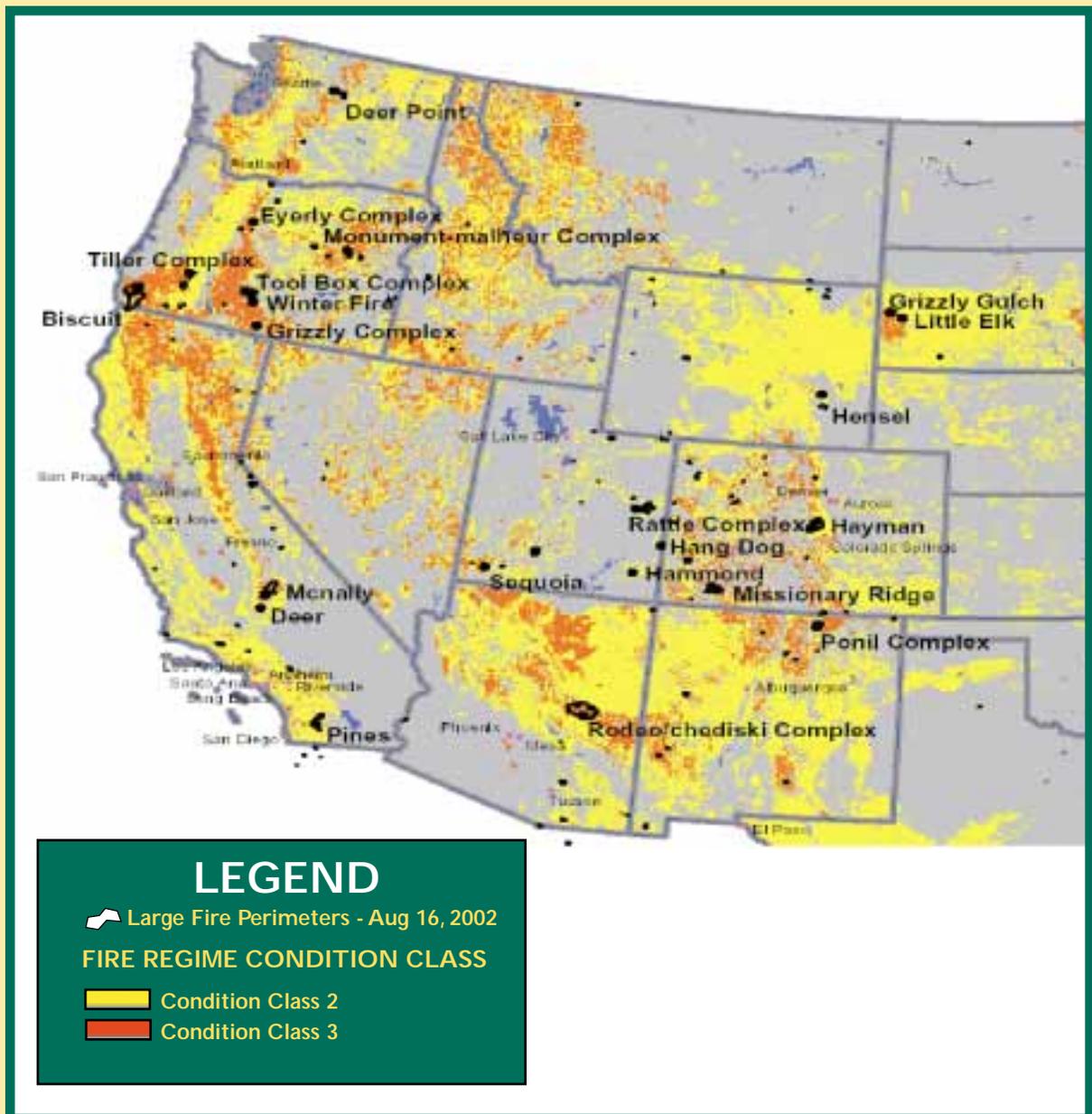


Rangeland sites entirely dominated by cheatgrass – unlike the native vegetation that formerly occupied this site – are highly vulnerable to fast-moving, higher-intensity wildfires.

Source: Restoring Fire-Adapted Ecosystems on Federal Lands. A Cohesive Fuel Treatment Strategy For Protecting People and Sustaining Natural Resources, Department of Interior and USDA Forest Service, April 2002 (Draft).

The coincidence between large wildfires and hazardous fire conditions is striking.

Figure 12. Large Fire Locations by Fire Regime Condition Classes 2&3 for All Historical Natural Fire Regimes



Source: Fire Perimeters: MODIS Satellite Imagery (Total number of fires from January 1 to August 16, 2002). Provided by USDA Forest Service.

Part II: Recommendations for Containing Wildfire Suppression Costs

Some improvements are being made in the cost-effectiveness of the federal wildland fire programs. However, it is time for a more strategic approach involving more joint efforts between federal and non-federal cooperators, and making better use of new technologies. **The Academy Panel recommends four strategic initiatives designed to:**

- **Hasten the job of reducing fuel loads and sharing the cost.**
- **Mitigate fire hazards at the interface between people and wildlands.**
- **Make managing large fire incidents more efficient and accountable.**
- **Speed the contributions of science, technology, and information management to cost-effective wildland fire management.**

Each initiative should have clear objectives, be quantified by appropriate performance goals and measures, and identify who is accountable for performance. This approach presents a strong challenge for the multiple players already involved in wildland fire programs, the highly decentralized organizations, and the differing federal land management agency cultures. However, the Panel advocates bringing more players into stronger partnerships to pursue the kinds of goals and objectives that will lead to success. Congress, the land management agencies, and the Wildland Fire Leadership Council (the interagency executive fire policy leadership and coordination team that includes the heads of the five land management agencies) all have central responsibilities in pursuing these four initiatives. They should forge strong partnerships with the other players named in each recommendation.

The Panel's four recommended initiatives follow. Their essential elements are outlined in this report, while their supporting materials and implementation details are contained in the *Background and Research Report*.

Initiative 1. A Comprehensive Fuels Reduction Strategy

Previous reports on hazardous fuels have documented the massive undertaking needed to overcome many decades of fuels build-up, a problem that exists on many federal, state, local, tribal, and private lands. The problem, no matter whose land it is on, also affects adjoining lands.

“Some improvements are being made in the cost-effectiveness of the federal wildland fire programs. However, it is time for a more strategic approach involving more joint efforts between federal and non-federal cooperators, and making better use of new technologies.”

The fuels problem and appropriate remedies vary from place to place. Greatest attention has been given to this issue in the West, where it is most severe. Even there, however, different fire regimes, including different types and conditions of vegetation, require different treatment. Needs differ in the Midwest, South, and East, as well. Figure 8 (on page 30) shows how the various fire regimes are distributed across the nation. For years, much prescribed burning has been conducted on a regular basis in the Southeast, and that practice is becoming more common in other parts of the country. Each land unit's FMP should detail these differences, outline specific goals, and schedule projects to reduce fire hazards and achieve ecological benefits.

Previous proposals for addressing fuels build-up call for massive federal expenditures over many years, yet even those plans have been labeled inadequate. There is a well-recognized need to channel investments to higher priority sites. Less recognized are the needs to: (1) share costs more equitably among the benefiting parties, and (2) better use available federal dollars. At the same time, this funding frequently is delayed or redirected by long planning and environmental review processes and appeals.

The Panel believes that the following actions could help achieve the nation's fuels reduction goal:

- Fully activate the fuels treatment options available through the National Fire Plan.
- Use an approach to fuels treatments and hazard mitigation that treats high-hazard areas inside and close to a community, including municipal watersheds, before treating more distant areas.
- Emphasize a biomass utilization strategy to encourage as many parties as possible to become active in clearing and finding economic uses for hazardous fuels.
- Develop a multi-party investment program to move closer to the level of fuels reduction on all owners' lands needed to

address the large scope of the fire hazard problem.

Fully Activate Current Fuels Treatment Options

According to the current Federal Wildland Fire Management Policy, fuels treatments should be planned and implemented on federal land units in accordance with approved FMPs that are consistent with approved LMPs. These plans are key to identifying lands where "fire use fires"—which allow fires to burn naturally under appropriate conditions—prescribed fire, thinning, and other fuels reduction treatments may be used.

Figure 9 (on page 31) illustrates the types of fire condition classes associated with different levels of risk. The objective of fuels reduction is to reduce the number of acres in high-risk areas, and increase the number in lower risk areas.

As documented in the *Background and Research Report*, current LMPs and FMPs do not cover all areas needing treatment. Delays in creating or amending these plans result from the need to use long, detailed, and costly planning processes that comply with diverse environmental and other laws and regulations, allow for long public review periods, and are subject to administrative and judicial appeals.

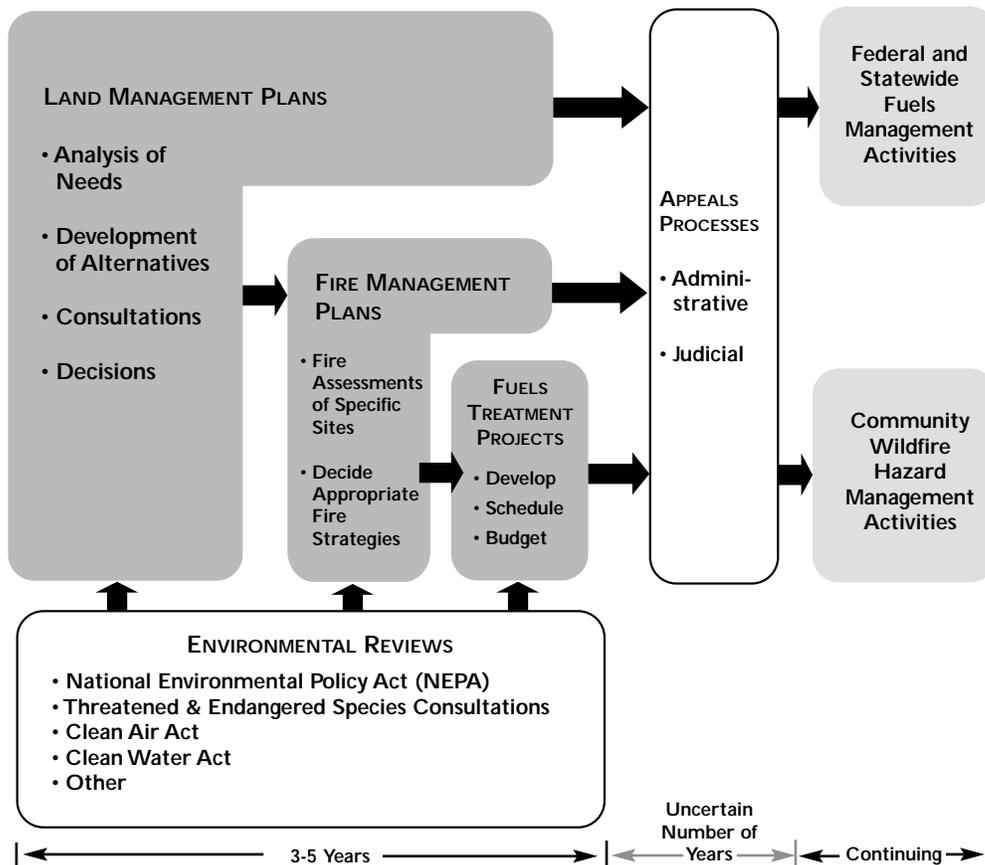
Due to these demanding procedures for planning and environmental clearances, it may take several years to prepare the required analyses for complex or controversial fuels treatment projects, particularly those involving projects that rely on commercial timber sale authority. Federal agencies may be faced with having projects tied up with appeals and litigation for a prolonged period. Consequently, federal land units often back away from critical plans and projects, rather than risk scarce time and money in an effort that may stretch out so long, or may never be approved. In many cases, the employees responsible for performing this planning and

environmental assessment work also are expected to manage their own fire management organizations, prepare prescribed burn plans, conduct prescribed burns, and respond to fires on their own units and beyond. Chart 4 characterizes these planning and review processes in a general way. In reality, these processes are much more complex, and they are handled differently by the various agencies.

It appears that the Forest Service is affected by delays in this process to a greater extent than other agencies due to its particular legislative

and regulatory history. Parties distrustful of Forest Service motives have been particularly active in challenging its planning and fuels management programs. These challenges are rooted in the perception that the agency tends to use fuels reduction programs as a means of authorizing commercial timber harvesting. The distrust stretches out the planning process and spawns lengthy appeals. This result is that many needed fuels treatment projects, for which funding is otherwise available, are not carried out in a timely manner, if at all.

Chart 4. Generalized Schematic Illustration of Agency Process Required To Authorize Fuels Management and Community Interface Wildfire Hazard Management



Some fuels projects create potentials for immediate negative environmental impacts, but these potentials must be weighed against the long-term devastating effects of large wildfires that are more likely to occur should fuels projects not be undertaken. To expedite the planning and fuels project approval processes, the Panel endorses actions to bridge the trust barrier, get the plans produced (or, in some cases, amended), and clear the appeals hurdles. These actions may be facilitated by independently-conducted scientific peer reviews of controversial agency studies, such as those on which the draft Joint Cohesive Strategy is based. Also, helpful would be the use of a more highly interactive and open planning process designed to involve the full range of stakeholders, resolve issues, and develop commitments to move forward together. These planning processes, however, are designed to resolve a wide range of issues, many of which may not be directly related to fire management goals and objectives. Thus, amending fire-related elements of these plans to expedite fuels management programs—without waiting for resolution of all other issues—may hold promise.

Recommendation 1. Planning Process Streamlining. **The Panel recommends that the federal land management agencies work with the Council on Environmental Quality, the endangered species regulatory branch of the Fish and Wildlife Service, the National Marine Fisheries Service, and the Environmental Protection Agency to examine the planning, consultation, and environmental review processes under the National Environmental Policy Act, the Endangered Species Act, and other planning and environmental laws, with the goal of standardizing, simplifying, and potentially consolidating these review processes while preserving the basic goals and tenets for which they were enacted.** One option worth considering is to conduct environmental reviews of entire FMPs and related projects, rather than require separate reviews of individual fuels treatment projects and activities—perhaps similar to some “programmatic” approval

approaches being used in the Department of the Interior and some other departments. The Panel recognizes that an initiative on this issue is already underway within the Administration.

The Panel supports an open environmental review process, but believes that reasonable time limits should be placed on these processes given the public safety urgency of fuels reduction goals. The Panel realizes that this is a complex and difficult issue, and urges Congress to authorize an independent review to ascertain how agency planning and environmental review processes, both of which slow the fuels reduction programs, can be streamlined while preserving the basic goals and tenets of existing environmental laws.

Because using fire to reduce hazardous fuels build-ups involves risk and environmental impacts, and because these treatments frequently cannot be used under prevailing conditions, the federal agencies have developed highly skilled prescribed fire managers and fire-use management teams (FUMTs). To expand the use of prescribed burning and fire-use for fuels reduction, the Panel believes that the agencies may need to take additional planning and staffing actions to plan and manage practical increases in this activity.

Treat Fuels Beginning with Values at Highest Risk

The Cerro Grande Fire near Los Alamos in 2000 demonstrated that hazardous fuel levels should be reduced in and around communities before igniting prescribed fires at some distance from the community. This lesson suggests that it is wise to give priority for fuels treatment to at-risk communities and their municipal watersheds or vital facilities to protect against wildfire hazards and escapes of prescribed fires. Lacking defensible space, these values at risk are considered so high that they demand the most expensive methods of all-out suppression on nearby fires—in other words, “throwing everything

they've got at it," regardless of cost. This scenario is being repeated more and more frequently. Under current congressional direction, 75 percent of funds appropriated for fuels treatment are to be spent to reduce hazards around communities.

Recommendation 2. Fuels Treatment Priority. The Panel recommends that fuels reduction activities be strategically located near communities and their important infrastructure assets. The Panel addresses the community interface issue more fully in Initiative 2.

Promote Biomass Use

Despite many years of homeowner and community education about their value, there has been relatively little action in clearing hazardous vegetation away from structures and thinning or breaking up continuous stands of fuels. One reason is that people like vegetation around them. Yet the difficulty and expense of disposing of or reusing the cleared material poses another real issue. Transportation costs often make removal impractical, as is burning this material on-site given environmental reasons. Interestingly, these types of problems resemble those that faced newspaper and other municipal recycling programs at their outset. There was no steady market to help pay for collection and reuse activity. However, the success of municipal recycling suggests that widespread organized efforts designed to ensure a continuous flow of material could attract the biomass utilization industries needed and make this efficient and largely self-funding fuels reduction method economically successful.

Recommendation 3. Biomass Use. The Panel recommends that the Wildland Fire Leadership Council lead revitalized efforts by the federal land management agencies to partner with communities and industry to promote biomass utilization programs that could create sustainable supplies of usable materials, jobs, and revenues at the local level to offset fuel reduction costs.

Selective, environmentally sensitive commercial harvesting often is part of the debate about the economic and ecological impact of hazardous fuels reduction projects designed to restore wildlands to the less hazardous Class 1 condition. Framed as a collaboratively planned and monitored stewardship and ecosystem improvement option, this approach should be explored as a way to introduce private resources (funding, people, and equipment) into the overall fuels management and wildfire hazard reduction effort. These private resources could significantly expand the effort, bringing it more in line with the size of the job to be done. The Stewardship Contracting pilot program, enacted by Congress in 1999, has begun to show how this approach can work to the satisfaction of most affected parties. This program applies only to the Forest Service now, but it should be expanded to include all Department of the Interior land management agencies as well. Energy generation from biomass is another of several potential sustainable applications under consideration to attract non-federal revenues to this effort.

Build a Multiparty Public Investment Program

The Panel believes that a system for prioritizing fuels treatment programs from the bottom up, such as BLM's Risk Assessment and Mitigation Strategies (RAMS) process, is a step in the right direction. It also believes that the system would be best used for large-scale planning and budgeting across multiparty land areas. This approach would bring together all the parties within an entire ecosystem or community-interface management area to identify the highest priority fuels projects and would include them in the budgets of appropriate local governments, local fire districts, states, and federal agencies, as well as the President's budget requests for the National Fire Plan. Every stakeholder should have a role in setting priorities, planning, taking appropriate action, and sharing costs. Current federal agency land management and fire management planning process requirements must be modified to permit agencies to participate in implementing these large-scale plans.

Recommendation 4. Wildfire Hazard Mitigation Program. The Panel recommends that Congress reexamine the National Fire Plan programs that provide assistance to non-federal parties and reshape them into a more comprehensive two-part—statewide and community-based—federal Wildfire Hazard Mitigation Incentive Program that is coordinated with the new state and local disaster mitigation planning program administered by the Federal Emergency Management Agency. This reshaped program should require recipients to take appropriate actions to mitigate wildfire hazards. Some or all of the program funds could be allocated from the existing NFP fuels management and community assistance appropriations. To be eligible for these grants, state and local recipients would participate in a RAMS-type risk assessment, planning, and budgeting process with their area's federal land units.

Some program funds should be set aside to support collaborative planning, the process' intergovernmental nature should be established in law, cost-effectiveness criteria should be established as a strong element in selecting projects, and steps should be taken to guard against federal agency dominance. The purposes of the reshaped program should include those in the existing programs, but be expanded to cover a broad range of options to meet the needs identified and prioritized in the collaborative planning process. Funding for implementation projects could come from this reshaped program, or NFP, state, local, or other appropriate sources. Non-profit landowner projects could be funded through state and local recipients in accordance with cooperative planning and prioritization processes established by the program. Private, for-profit landowners should be invited into the planning process, but not be eligible for funds. Figure 10 illustrates some basic characteristics of this two-part program.

The surface transportation program is one potential federal-aid planning process to consider as a model for designing this new mitigation incentive program. This program includes statewide and locally-based regional planning and project funding programs that have been proven effective. They produce financially realistic lists of projects for implementing long-range plans one step at a time by diverse public and private parties.

Using this model, about 50 state recipients would be in the program, as well as about one thousand community-based county-wide or multi-county hazard reduction management areas. Regions could be identified and prioritized using objective risk and vulnerability criteria, and funded by appropriate formulas. This would be a more practical approach than federally prioritizing and individually funding the 22,000 communities currently on the at risk list.

Figure 10. Proposed Two-Part Wildfire Hazard Mitigation Incentive Program

Community Hazard Mitigation Program	Statewide Wildfire Fuels Management Program
Recipient: County-wide or multi-county intergovernmental council.	Recipient: Appropriate state department of forestry, natural resources, or land management; with a state level intergovernmental wildfire planning council.
Purpose: Mobilize all governmental and non-governmental cooperators in the federally recognized community interface management area for coordinated action to assess and mitigate wildfire hazards and enhance local firefighting preparedness.	Purpose: Mobilize all governmental and non-governmental cooperators in the state outside federally recognized community interface management areas to assess and mitigate hazardous fuels on wildlands and enhance natural ecologies.
Strategic Plan: The recipient would prepare and adopt a long-range strategic plan setting forth the wildfire hazard mitigation and biomass utilization outcomes and performance goals sought on all lands in the community interface management area. This plan would identify the roles and responsibilities of local governments and landowners for implementation actions needed in the community interface area.	Strategic Plan: The recipient would prepare and adopt a long-range strategic plan setting forth the wildland fuels reduction and ecological health outcomes and performance goals sought on all lands in the state outside community interface management areas. This plan would identify the roles and responsibilities of those responsible for the public and other lands included in the plan.
Implementation Plan and Budgets: The recipient would prepare and adopt a short-range (1-3 year) action plan consisting of specifically identified and prioritized implementation projects to help achieve strategic outcomes and performance goals. The projects would represent action, financial, and budget commitments by identified parties.	Implementation Plan and Budgets: The recipient would prepare and adopt a short-range (1-3 year) action plan consisting of specifically identified and prioritized implementation projects to help achieve strategic outcomes and performance goals. The projects would represent action, financial, and budget commitments by identified parties.
Project-Eligibility: Implementation projects would be required to be in this plan and include appropriate budgets that provide matching funds to be eligible for NFP implementation funds. Local recipients would be eligible to receive NFP project funds only if the community where they are located has adequate local codes and ordinances and enforcement for promoting wildland fire safety.	Project-Eligibility: Implementation projects would be required to be in this plan and include appropriate budgets that provide matching funds to be eligible for NFP implementation funds. State recipients would be eligible to receive NFP project funds only if they enact enabling legislation that allows local governments to adopt and enforce effective codes and ordinances to promote wildland fire safety.
Matching Funds: The community interface mitigation program recipient would match the federal funds received with state or local sources available to it. Funds received from FEMA for disaster mitigation planning may be counted for matching the planning portion of this program.	Matching Funds: The state would match the federal funds received with sources available to it. Funds received by the state from FEMA for disaster mitigation planning may be counted for matching the planning portion of this program.
Coordination: The community-based community interface strategic and implementation plans would be required to be consistent with the counterpart statewide plans.	Coordination: The statewide strategic and implementation plans would be required to be consistent with the community-based plans in the state.

Results

The Panel believes that implementing these fuels reduction recommendations could produce the following results:

Short-Term

- Fewer structures will be lost to fire.
- Treated areas will have lower wildland fire hazards, smaller fires, and decreased suppression costs.
- Increasing the number of acres treated will lead to healthier, natural ecosystems.
- The nationwide growth of suppression costs will slow.
- Cost-shared biomass utilization, stewardship contracting, and matching grant programs will play a larger role in reducing fuel hazards, thereby supplementing federal appropriations.

Long-Term

- Fire hazards will be reduced nationwide.
- The number of large, long-duration fires will decrease.
- Suppression costs will be contained nationwide.

Initiative 2. A Community Responsibility Strategy

As wildlands and human activities come together, firefighting costs rise dramatically and options diminish substantially. Most cost containment opportunities are already determined by preparations made—or not made—prior to a fire. Regulatory and infrastructure decisions, made at the state and local levels about locations and conditions for development, can significantly affect how a wildland fire is fought and how much it will cost. To motivate communities to take responsibility for reducing their vulnerability to wildfires, the Panel believes that Congress and the federal land management agencies should require the use of effective planning and zoning ordinances, building codes, and other regulations

that include fire hazard reduction requirements; the development and use of robust wildfire disaster mitigation programs; and strategies to avoid development that is hard to protect in fire-prone areas. Although still relatively rare, the Panel found examples of local programs to guide this effort.

Recommendation 5. Community Responsibility Practices. The Panel recommends that the Wildland Fire Leadership Council, in cooperation with state and local officials, give high priority to developing interagency regulations to guide coordinated and consistent administration of the community responsibility practices and risk mitigation part of the Wildfire Hazard Mitigation Incentive Program recommended in Initiative 1.

Experience suggests that the key activities addressed should include:

- Identifying the locally-based community interface management area, governing mechanism, and staffing capability needed to pursue the mobilization effort.
- Securing funding for community responsibility and hazard mitigation activities from the new federal Wildfire Hazard Mitigation Incentive Program and a variety of sources of matching funds, including local government taxes, other state and federal grants, fire district taxes, volunteer fire department revenues, and contributions from community associations and private fire protection districts and organizations.
- Performing area-wide fire-risk and hazard assessments, and prioritizing the most needed actions to reduce wildfire risks within the area.
- Enhancing public education about wildfire risks and practical means of mitigating them.
- Developing a joint federal-state community rating system for wildfire protection and preparedness.

- Promoting enactment and enforcement of local ordinances that would require community-wide wildfire protection based on models available from the International Codes Council, the National Fire Protection Association, and others.
- Working with property owners to bring their houses and other structures into compliance with new codes and ordinances.
- Training, equipping, and certifying local fire departments to build increased capacity in community-interface areas to fight wildfires cooperatively, develop effective and reliable workforces, and establish mutual-aid and cost-sharing agreements with nearby federal, state, and tribal fire departments.

In fire-prone areas, local fire departments should be well trained to fight wildfires, develop effective and reliable workforces, be on the active registers maintained by emergency dispatch centers, and engage in joint exercises to prepare them to conduct initial attack and become an effective part of a unified command. Local fire equipment and training grants are available from the five federal land management agencies and FEMA's U.S. Fire Administration to promote local preparedness; approximately 20 percent of current grant applications are being funded. Under the existing programs, however, applicants must apply to multiple federal agencies to ensure full consideration, and coordination among the agencies is uneven. To reach full potential, these programs must be more effectively and efficiently coordinated.

Fire management operations are more effective when cooperators clearly understand their roles, responsibilities, and financial obligations for suppressing fires. Mutual-aid and cost-sharing agreements among cooperators delineate those responsibilities. However, the case studies show that these agreements are not always in place and do not allocate costs based on the proportions of values protected. Federal agencies frequently cover all or most of these costs.

Recommendation 6. Cost Sharing. The Panel recommends that equitable cost-sharing agreements be guided by Congressionally-established criteria to share costs proportionally based on jurisdictional responsibilities and values protected.

The official list of communities at risk from wildfires totals approximately 22,000 locales. Prioritizing them and getting them to take fire-proofing actions are a daunting challenge. The Fire Hazard Management matching grant program recommended earlier could help to accomplish this goal. FEMA's new state and local disaster mitigation planning program also could be used to this end. The latter is a prerequisite to continued eligibility for FEMA disaster mitigation assistance following an event; so there are significant incentives to pursue it. These two programs could be much more effective together than separate. Planning and other program requirements should be consistent so that any community meeting the requirements of one program would be deemed to meet the requirements of the other.

To boost community-wide preparations for disaster resistance, the Wildland Fire Leadership Council should direct that a system be developed to ensure prioritization of wildland interface communities; provide multiple sources of assistance to promote coordinated fire hazard mitigation and preparedness capabilities; include a community preparedness recognition program, perhaps tied to a break on insurance rates, developed jointly by federal, state, and local officials; and promote participation in the community biomass collection and utilization program previously recommended. The community recognition program could build on the new Firewise Communities/USA effort.

Results

The Panel believes that implementing these community responsibility recommendations could produce the following results:

- Communities at risk will play a larger role in reducing their own vulnerability to wildland fire and share suppression costs more equitably.
- More property owners will reduce their vulnerability to wildland fires.
- Communities will be better able to protect themselves from wildland fires, thus reducing the federal agencies' burden to provide suppression actions.
- Suppression costs and losses of assets will likely decline in and around those communities that act to reduce wildfire risk.

Initiative 3. Incident Management Efficiency and Accountability

The Academy study team identified the top priorities in managing large wildfires as ensuring firefighter and public safety and protecting homes, businesses, natural resources, infrastructure, and other urban and non-urban values. Cost is a secondary concern. Mechanisms have been put in place to improve IMT efficiency, but they have been no match for such cost-increasing factors as high volumes of dry fuels, drought, adverse weather conditions, inaccessible terrain, and structures and other valuable community and natural resource assets to be protected. The level of inaccessible terrain has increased in recent years due to reductions in road mileage

on public lands. Box 1 lists several types of natural resources that may need protection and the types of firefighting decisions that may be limited given related restrictions. Limits on firefighting decisions may increase or decrease suppression cost, depending on the specific circumstances.

The six case studies probed incident management efficiency and accountability. Results suggest opportunities for improving firefighting efficiency in five areas:

- providing adequate resources for suppressing large fires
- prepositioning strategies and supply/dispatch system performance
- firefighting strategy selection tools
- business management systems
- post-fire cost reviews

Large-Fire Suppression Resources

Estimating and providing the type and number of firefighting resources needed are critical factors affecting the federal land management agencies' ability to suppress wildland fires. Currently, these agencies use three different computer programs to plan for initial attack resources, including personnel and equipment positioned at national forests, parks, and other federal land units to fight fires. None is as capable as it should be to account for resources other

Box 1. Natural Resources To Be Protected and Related Restrictions

Some Natural Resources To Be Protected	Some Firefighting Decisions That May Be Affected
<ul style="list-style-type: none"> ■ Threatened and endangered species ■ Wilderness and scenic values ■ Streams and rivers ■ Water quality ■ Fisheries ■ Nesting sites ■ Soil 	<ul style="list-style-type: none"> ■ Use of mechanical equipment ■ Use of fire retardant ■ Helicopter/air tanker over flights ■ Fireline construction ■ Locations of incident command posts, camps, and other facilities ■ Fuel storage ■ Noxious weed control, including decontamination of mobile equipment

than fully dedicated federal ones. Recently, however, the five agencies embarked on a project to develop a single improved budget model.

Recommendation 7. Preparedness Budget Model. The Panel believes the project to improve and integrate the agencies' preparedness resource estimation models is an important initiative and recommends that it be pursued expeditiously. Federal employees whose primary jobs are not firefighting are less available to fight fires now than in the past. Therefore, the Panel believes it is important to increase the use of nearby non-federal personnel who are anxious to help. The new resource estimation model under agency development should account for these non-federal resources. The Panel also believes it is important to have independent outside experts peer-review the new model to ensure its quality and objectivity.

At present, only 30-35 percent of the agencies' total fire budgets consist of resources planned and justified by the initial attack analysis programs. In addition, independent cost/benefit studies have analyzed other key components of the fire suppression programs supporting extended attack and large fire suppression. For example, occasional studies performed on an ad-hoc basis have justified the need for 7 exclusive-use national resource helicopters and 43 heavy air tankers.

However, many other key resources for large wildland fire suppression, such as Type 1 and 2 IMTs and crews, Geographic Information System (GIS) units, and mobile food units, have not received national analyses that examine the relative costs and benefits of their contribution to fire suppression effectiveness. The current levels of these critical components are largely a product of historic use and market factors. In recent years, increased firefighting resource levels have been procured by contract. This process has produced a mixed system of national and regional contracts for air tankers, radios, GIS

units, line crews, hand tools, and administrative units that may be brought in from distant locations. The means for deciding the best method of purchase and utilization of resources and for maintaining quality standards do not appear to be systematic or readily understandable.

The Panel believes that a more analytical estimation process should determine appropriate resource levels of these resources.

Recommendation 8. Large-Fire Suppression Resources. The Panel recommends that the land management agencies develop a national budgeting methodology to analyze the cost, benefit, number, composition, location, mobility, productivity, and seasonality of each type of large-fire suppression resource. The Panel believes the Wildland Fire Leadership Council should lead this work.

To help implement this recommendation, the Panel believes that:

- Land units should examine whether their fire management programs could benefit from developing additional locally committed Type 3 IMTs consisting of federal, state, and local firefighters who are not committed to serving on Type 1 or 2 teams.
- Agencies should provide incentives to increase the proportion of their own employees who participate in some adjunct firefighting or fire-support activities related to large-fire suppression although their primary jobs are not firefighting.
- Agencies should consider using an acquisition model that quantifies advantages and disadvantages of supply options to aid in decisions to purchase firefighting resources and some method of performance evaluation to monitor quality and performance, especially for contracted crews. Important issues to resolve should include:

- optimizing the use of local and nearby resources
- minimizing the use of unusually high-cost resources
- determining the most cost-effective mix of supply sources
- upgrading the performance of certain firefighting crews

Given that human resources are a key to wildland fire management strategies, and that the functions they are expected to perform continually change in significant ways, the agencies should assess and develop the number and types of new skills and qualified personnel needed to meet current and future prescribed fire and other fuels management programs. This topic was addressed in Chapter 7 of the Academy report, *Managing Wildland Fire: Enhancing Capacity to Implement the Federal Interagency Policy*, (December 2001). The previous Academy panel recommended a more comprehensive interagency, intergovernmental, and interdisciplinary workforce analysis and planning strategy, including significantly broadened and upgraded efforts to enhance the capacity of the future workforce.

Traditional reliance on temporary assignments of land management agency staff who hold other primary jobs is no longer adequate to provide the numbers of personnel and types of specialized qualifications required to meet the increased demands for fire prevention, hazard mitigation, fuels management, and other purposes. In particular, the demands for more sophisticated decision-making aids, the employment of more advanced technologies, and the requirement to demonstrate cost-effectiveness suggest the need for constant development of a human resources cadre and a workforce development program that is different than the one traditionally relied upon. This will require the agencies to engage in systematic workforce assessment, planning, and development with the view toward developing, training, and employing a fire program workforce for the 21st century.

Prepositioning Strategies and Supply/Dispatch System Performance

Being prepared to fight unwanted wildland fires—those that need to be suppressed for safety or other reasons—is an important factor in reducing large wildland fire suppression costs. Aside from fires that were prevented, those costing the least in the short run are those that do not become large. These small fires are largely fought with local equipment and workforces, requiring no big transportation costs, large fire camps and related facilities, outside crews and incident management teams, or aircraft beyond those required for initial attack.

When lightning is forecasted for a local land unit experiencing high or extreme fire danger, fire managers can use available “severity funding” allocations to preposition additional initial attack resources to deal with expected multiple ignitions, thereby reducing the probability of fires escaping and becoming large and costly. The recently established agency Predictive Services units are improving this cost savings potential. Keys to achieving optimum preparedness across all areas at risk are continued enhancements to remotely sensed weather and other data, as well as analytical capabilities using GIS. These resources are vital to the Predictive Services units, and an increasingly nimble supply and dispatch system that maintains adequate initial attack forces at the right places at the right times.

The capacity to move resources around efficiently becomes most critical, especially during severe fire seasons. Extra efforts to prevent human-caused fires are also often made at those critical times, to the extent that resources permit. For example, prevention patrols are added, contacts with the public and industry increased, and other steps taken to raise visibility.

Recommendation 9. Preparedness and Prepositioning Resources. The Panel believes that it is essential to maintain and improve high levels of preparedness and effective

prepositioning programs, and recommends that Congress and the agencies make adequate provisions for these activities through their budget and appropriations processes.

During the extraordinarily severe fire season of 2000, the number and size of fires were so great that they overwhelmed the ability of the largely manual supply and dispatch system to get personnel, equipment, and supplies to the fires. In the midst of the season, GIS hardware and software companies and federal agencies pitched in on an emergency basis to assemble the first automated tracking system. The agencies are now developing an automated inventory control and dispatching system—called Resource Ordering and Status System (ROSS)—to track materials and personnel. ROSS is only partially operational and less capable of using GIS than the system initiated in 2000. Some regional dispatch centers continue to use GIS capabilities to help them assess and match their needs and resources.

Recommendation 10. Internet-Based Supply and Dispatch. The Panel recommends that the National Wildfire Coordinating Group continue to enhance internet-based supply/dispatch coordination systems providing both alphanumeric and geographic information capabilities under the guidance of the Wildland Fire Leadership Council. The operational and public information functions are important both to the smooth and cost-effective administration of the wildland fire program. The system must be able to predict emerging shortages and reorder as quickly as possible; direct needed items to fire sites as cost effectively as possible; and provide easily understood geographic status information to everyone who needs it.

Firefighting Strategy

WFSAs are the primary method for selecting the best strategy for fighting a large wildland fire. It is designed to reflect the land unit's LMP and the FMP linked to it. These policies and plans are to be reflected in the official "delegation of authority" given to an IC when he or she takes

charge of the fire. Well-prepared FMPs give clear guidance about specific geographic areas where fire is to be excluded, carefully reintroduced by human intervention, or allowed to burn naturally under appropriate conditions.

Based on the six case studies, the Panel found a substantial need to improve the WFSAs. The case studies revealed that during extended attack, the incident commander and agency administrator often use basic WFSAs questions to assess the situation quickly, select a strategy, and take action. Preparing the formal WFSAs frequently follows and documents the decisions already made without thoroughly examining pertinent data. Alternative strategies may not be considered; even if they are, they may not influence strategy selection. The WFSAs process is often seen as too cumbersome, and its benefits not well understood. Field staffs seldom know how to complete it, and the process is often not used as intended. Yet, it is the only tool designed to evaluate alternative strategies against their estimated costs.

Recommendation 11. WFSAs Improvement. The Panel recommends that the Wildland Fire Situation Analysis be fixed rather than abandoned, and that the Wildland Fire Leadership Council convene a task force of users, decision scientists, geographic information system specialists and others to overhaul this important tool. The Panel believes that the initial WFSAs, prepared by the land unit before the IMT arrives, should be simplified to enhance its potential to help agency administrators recommend the most cost-effective type of IMT and firefighting strategies based on the overall situation. To the extent possible, WFSAs prepared at this stage should make better use of GIS, remote sensing, fire behavior, and weather specialists, and should more fully consider non-federal values to be protected. The Panel noted that some land unit staffs did not have the requisite expertise to effectively prepare the WFSAs and may need outside assistance. When the initial WFSAs is reviewed with the arriving IMT, a revised WFSAs should be prepared collaboratively if necessary.

Business Management Systems

Incident Business Advisors (IBAs) are now used on many large fires to advise agency administrators about the appropriate use of funds in firefighting. They also work closely with the IMT to promote the effective use of good business management practices. On the case studies, the Academy field teams found that agency administrators and IMTs valued IBAs when they were used, and considered them to be an important resource for identifying cost-related issues during the fires.

Recommendation 12. IBA Requirement. The Panel recommends that agency administrators be required to assign Incident Business Advisors for all Type 1 and Type 2 fires. The Panel further recommends that the National Wildfire Coordinating Group work with the agencies to train and supply adequate numbers of qualified personnel to assume the IBA duties.

The Panel found that business management deficiencies sometimes lengthened mobilization and demobilization processes and increased their costs. For example, re-inventorying equipment and personnel for demobilization, caused by inadequate resource tracking capability, resulted in delayed release of crews and equipment for one fire, costing extra time and money.

Recommendation 13. Automated Systems and Technologies. The Panel recommends that the agencies, together with the National Wildfire Coordinating Group, work toward universal deployment of an I-SUITE type of automated business management system such as the one now beginning to be used. The Panel also recommends that they adopt barcode and smart card technologies to improve the tracking of equipment and personnel assigned to the fire.

Transitions between IMTs are a critical wildfire event. If management continuity is disrupted, there can be increased risks to firefighter safety and reduced suppression effectiveness. Multiple transitions on long-duration fires also can be

difficult for the land unit and local cooperators, as they must re-establish relationships with each new team and adapt to a new way of doing business. Not insignificantly, team transitions also cost money.

The normal IMT assignment to a fire is now 14 days, excluding travel (down from the previous 21-day period). This shorter limitation is intended to protect the health and safety of the personnel and to encourage their home units to make them available more readily. However, this period may be extended to 21 days under certain conditions, by agreement of the IMT and land unit's agency administrator. IMTs are sometimes transferred from one fire to another part way through the 14-day period and then rotate off the second one within a few days.

Recommendation 14. Management Continuity. The Panel recommends that greater attention be given to improving management continuity by avoiding unnecessary and potentially disruptive Incident Management Team transitions, reviewing transition procedures and problems with data and equipment in compatibilities that impede smooth transitions, and improving procedures as needed.

The Panel encourages the agencies to exercise greater flexibility in applying the 14-day rule for IMTs. When transitions between IMTs occur, they should include full information sharing so that the incoming team can assume operational command smoothly. In at least two cases, Academy field teams found problems with teams exchanging maps, databases, and other key information. The incoming IMTs had to recreate this essential information, lost valuable time in the process, and thereby increased the cost of fighting the fire.

Post-Fire Cost Reviews for Accountability

The Federal Wildland Fire Management Policy states that "Fires are to be suppressed at minimum

cost, considering firefighter and public safety, benefits, and values to be protected, consistent with resource objectives.” The Academy field teams found that concerns about safety and values to be protected correctly far outweighed cost considerations in the cases studied. However, agency leaders must send a clear message that cost should be an important consideration when fighting wildland fires.

Recommendation 15. Required Cost Reviews. To reinforce the cost containment goal, the Panel recommends that the Wildland Fire Leadership Council require the agencies to conduct post-incident reviews using specified criteria including size or cost for a representative sample of large fire incidents to assess how their costs were managed and share the lessons learned. These reviews should become part of the interagency process for incident reviews and reporting recommended in an Academy Panel’s December 2001 report, *Managing Wildland Fire: Enhancing Capacity to Implement the Federal Interagency Policy*. They should also be analyzed individually and together to identify best practices that should be disseminated and replicated, and consider patterns that may need correction. In this manner, the reviews should support a continuing learning process and provide the foundation for a new cost-oriented accountability system. The latter appears to be largely absent at the present time. The Panel believes that these independent reviews also could be used to develop and validate performance measures to assess

the cost performance of agency administrators, incident commanders, and IMTs involved in a significant number of suppression activities during the past season.

To propose a process for post-fire cost reviews, the Academy staff developed a checklist of factors to be addressed and questions to be asked using prior reports and studies. The factors should be addressed by the IC, Finance Section staff, land unit budget and finance personnel, IBA, and Agency Administrator. Also, they should be documented in written and computerized records of the individual large fires. Box 2 provides an illustrative summary of some potential evaluation factors. They are similar to those found on informal checklists used by experienced ICs. However, a formal list is needed to promote consistent practices when managing and evaluating large fires, as well as in evaluating them. Other checklists designed to serve as reminders to improve efficiency and effectiveness include: *Standards for Fire and Aviation Operations*, *Fireline Handbook*, *Principles of Retardant Application*, *Wildland Fire Suppression Tactics Reference Guide*.

Alignment of the criteria used to manage operations with those used to prepare evaluations would help to institutionalize a cost-accountability process. Potentially, this list and other approaches could evolve into clear measurement standards for assessing the appropriateness of fire suppression costs in managing large wildfires.

Box 2. Illustrative Checklist of Fire-Suppression Cost Factors To Consider in Managing Fires and Conducting Post-Fire Cost Reviews

Key Decision Points
<ul style="list-style-type: none"> ■ Evaluate strategies and tactics from the standpoint of: <ul style="list-style-type: none"> - Firefighter safety - Costs compared to benefits - Work accomplished from previous operational periods - Staffs operating within guidelines, including cost efficiency ■ Review costs daily; undertake a cost-efficiency analysis for all high-cost items, such as helicopters and other specialized equipment; and analyze the effects of the Complexity Analysis on costs. ■ Declare the fire controlled as soon as practical to achieve cost reductions by halting the payment of the 25 percent hazard duty pay. ■ Identify and demobilize resources, both personnel and equipment, to reduce salaries and support costs, such as contracted state and local personnel and services. ■ Review definitions and expected fire boundaries for containment and control strategies. ■ Review and revise strategies when expected weather events are delayed and costs continue to mount.
Crews
<ul style="list-style-type: none"> ■ Identify, order and deploy appropriate crews matched to the anticipated tactical needs. ■ When extreme fire behavior conditions are forecast, work on areas of the fire where it is safe to accomplish effective tactical actions, such as at the heel or flanks of the fire.
Aircraft
<ul style="list-style-type: none"> ■ Assess the need for and use of appropriate aviation resources for current and expected tactical assignments. ■ Take advantage of lower fire intensity that normally occurs in mornings in burning periods to increase effective use of aircraft. ■ Do not use aviation resources when they are ineffective or dangerous to fly because of: <ul style="list-style-type: none"> - Extreme burning conditions and fire behavior - Strong winds - Inadequate ground crew support in the area - Extreme smoky conditions or atmospheric inversions that limit visibility
Equipment
<ul style="list-style-type: none"> ■ When extreme fire behavior conditions are forecast, work on areas of the fire where it is safe to accomplish effective tactical actions, such as at the heel or flanks of the fire. ■ Avoid holding heavy equipment in staging areas for extended periods.
Firelines
<ul style="list-style-type: none"> ■ Take advantage of barriers to shorten line construction needs. ■ Consider all methods of line construction including dozer, hand, cold trailing and fireline explosives. ■ Ensure that selected mop-up standards are acceptable to the fire unit and agency administrator. ■ Consider establishing camps closer to the fire work area when distances from the incident base or fireline are excessive and operational shifts are long. ■ Consider coyote tactics, (e.g. work and sleep close by the fire), to avoid extensive operational shifts when firelines are a long distance from roads or other access points.
Contracting
<ul style="list-style-type: none"> ■ Evaluate production efficiency and costs per hour against the need for extended shift lengths for equipment. ■ Ensure accountability from single resource bosses to monitor time, performance and effectiveness of contract crews, personnel and equipment.
Local Resource Utilization
<ul style="list-style-type: none"> ■ Take advantage of trained local resources for prompt organization and management of initial and extended attack fires. ■ Use trained local resources to meet specific needs on longer duration fires.

Results

The Panel believes that effectively implementing these incident management recommendations could produce the following results:

- Initial/extended attack will become more successful in keeping fires small.
- The number of acres rendered safer and healthier by “fire-use” fires increases as a broader range of alternatives is considered in selecting firefighting strategies.
- IMTs will become more cost conscious and efficient.
- Accountability for costs will become better institutionalized in the fire management programs.

Initiative 4. Cost-Effective Applications of Science, Technology, and Information Management

The federal land management agencies continually adopt new technologies for wildland fire management and implement the results of ongoing programs to evaluate new equipment proposals, improve fire behavior models, and much more. However, the fire-related research programs are highly dispersed within and among the Forest Service, U.S. Geological Survey, National Weather Service and other parts of the National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, states, and university forest research centers. The agencies have recently established a new Interagency Fire Research Coordination Council (IFRCC). This is a step in the right direction, but the Panel found that links among the Wildland Fire Leadership Council, IFRCC, the Joint Fire Science Program (JFSP), and other research projects need to be further strengthened. Wildland fire-related research and development (R&D) is too incremental, and user needs for R&D and technology transfer activities require further enhancement.

The Panel believes that the Wildland Fire Leadership Council should promote strong linkages among it, the IFRCC, JFSP, and other fire-related R&D and technology transfer efforts. The Council also should focus on developing and implementing coherent strategies to achieve the following fire-related goals:

- Focus fire-related R&D programs on user needs by creating a more comprehensive, user-driven plan.
- Create an overall Information Technology/Information Management (IT/IM) framework for wildland fire management and related activities.
- Upgrade and integrate the agencies’ computer modeling and decision-support programs for wildland fire programs.
- Improve the data available for wildland fire management, including geographic information systems and data capabilities useful for measuring performance.
- Expedite deployment and utilization of new developments.

Focus R&D Programs on Users

Fire program managers interviewed for this study said they traditionally had some, but only modest, input and influence on fire-related R&D programs and management-funded projects. This is changing. The JFSP, created in 1998 to focus on fuels management objectives and practical applications, has an appointed governing board with five members from the Forest Service and five others from the Interior land management agencies and USGS. This program also has a Stakeholders Advisory Group to provide advice and recommendations to the Secretaries of Agriculture and the Interior through the governing board. The Advisory Group held its first meeting in June 2001 and developed a comprehensive list of recommendations for future work. In 2002, the Forest Service created the IFRCC with several agencies’ senior program managers to provide leadership in coordinating and representing wildland fire science and technology development and application under the NFP. These and other

initiatives are useful for bringing researchers and line managers together. Nevertheless, the Panel believes a broader, user-focused R&D plan for wildland fire management is needed to ensure that research results benefit firefighters on the line.

The Panel agrees with previous studies that firefighting technology is advancing rapidly and changing the ways that fires are being fought. Changes are taking place in such areas as protective gear, suppression equipment and agents, the use of satellite technology for detection, monitoring, and dispatch communications, and decision-making tools. However, much of the research appeared incremental and focused on identifying available enhancements. It also occasionally lacked practicality. If the question became, “What do we need?”, not, “What is available to help us?”, R&D programs could be more relevant to the firefighter.

Recommendation 16. Strategic Plan for R&D. The Panel recommends that the Wildland Fire Leadership Council strengthen its ties with the Interagency Fire Research Coordination Council and direct development of an increasingly comprehensive, user-driven strategic plan for research and technology development to provide a stronger focus on the most pressing challenges of fire management.

For this approach to be successful, the Panel believes that greater contact is necessary with the larger science, technology, and R&D communities. Contacts already exist between the land management agencies and the state and international communities conducting fire-related research. Yet, there may be additional opportunities in related fields. The Panel believes that the IFRCC should reach out more intensively and inclusively to other governmental and non-governmental science organizations in the aviation, military, and private sectors.

This strategic approach to R&D should lead to increased emphasis on equipment upgrades, including telecommunications and safety equipment, as well as actual firefighting tools

that could help reduce program costs. For example, could redesigned, better-equipped, and smaller fire crews be made as effective as current 20-person crews? Another result might be increased emphasis on human factors research.

Communication challenges also require special attention and action to address the differing and incompatible communications systems, devices and frequencies that have plagued federal, state, and local firefighters as well as responders to other emergencies. For example, both analog and digital radios are commonly utilized through the traditional fire deployment mechanisms. IMTs require access to high speed Internet services and use of data available through the Global Positioning System (GPS). The National Telecommunications and Information Administration is moving the nation, including the firefighting community, toward a new narrowband radio system and helping to address the other communications issues. The Federal Communications Commission also is taking steps to improve public safety communications systems access.

As these modifications and improvements move forward, it is imperative that the land management agencies work together with state, local, and tribal firefighters to ensure interoperability. This should avoid a very real potential that crews, aircraft, and equipment arrive on a wild-fire without compatible communications, leading to confusion, delays, increased costs, and very likely jeopardizing firefighter and public safety. The NWCG should continue its efforts to address these issues and assist in efforts that will result in cost-effective solutions to wildland fire communications compatibility and reliability problems. These initiatives should be pursued in cooperation with homeland security projects and funding.

Information Technology/Information Management Framework

IMTs and local land units use many information systems and computer applications, such as the

ROSS supply/dispatch system, Incident Qualification Certification System (IQCS) and I-SUITE. The Panel applauds these individual efforts, but believes they would be more effective as part of an overall strategy to improve the efficiency of wildland fire management and realize cost savings. Too often, these innovations do not connect to one another or move captured information into regional and national databases used to improve program performance and cost-effectiveness and evaluate results. One consequence is that the full costs of a large fire are not known until many months (or even years) later, affecting accurate cost allocations among cooperators. In addition, there is little ability to study national and regional cost experiences, or to analyze the cost-effectiveness of different firefighting equipment and contract services.

A national information technology/information management (IT/IM) framework is needed to guide future development and deployment of IT/IM systems and information sources to support more cost-effective fire suppression. This framework would provide architectures for systems, applications, data, and networks based on user-identified needs. It also would provide the foundation for integrating key sub-system elements so they can ultimately produce the desired overall benefits.

Recommendation 17. National Wildfire Information Framework. To establish an effective national fire-related information technology/information management framework, the Panel recommends that the agencies work together under the guidance of the Wildland Fire Leadership Council to describe (a) what the desired system and data sources should accomplish for fire management, and (b) how individual components and data sources can become functioning parts of the overall system.

The Panel endorses the recently established Project Management Office within NWCG as a step in the right direction. However, other potential models for this initiative could be the Department of Defense's Defense Information

Infrastructure Common Operating Environment (DII COE), now under development, and the Federal Enterprise Architecture (FEA), being promoted by the Office of Management and Budget as part of the President's Management Agenda.

The DII COE is a software infrastructure that enables mission applications to share common support applications, such as the Commercial Joint Mapping Toolkit. The DII COE is to evolve in compliance with mandated standards. Not every element is applicable to fire planning and suppression management, but the basic concepts and DoD development experiences could be instructive to the recommended IT/IM framework.

FEA is a framework for cross-agency, government-wide improvement of business-type processes such as budgeting, information sharing, performance measurement and management, cross-agency collaboration, citizen service, and more. This initiative might offer assistance in developing similar systems to serve the wildland fire program.

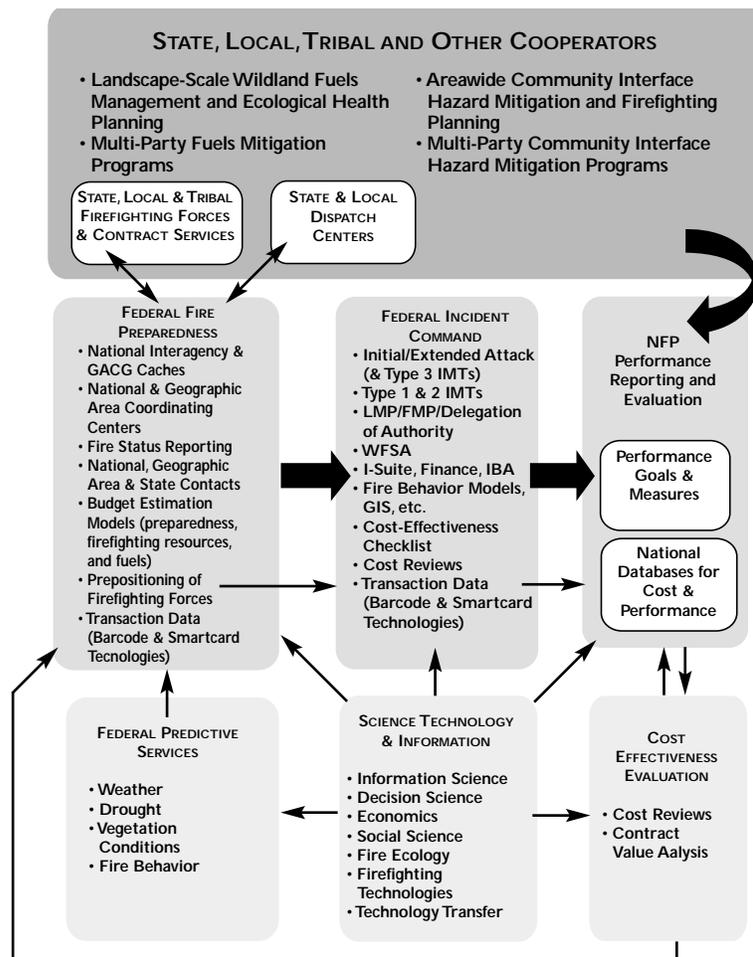
The overall IT/IM framework recommended for wildland fire should be able to satisfy needs for:

- more efficient and timely financial and business management
- geographic information management systems at many different scales to meet planning, environmental protection, firefighting, recovery and other needs
- integrated planning and performance budgeting systems
- more efficient risk assessment and fire incident management
- increasingly efficient and responsive supply and dispatch functions
- national databases to support program evaluation and program improvement
- compatibility with the IT architectures of the Departments of Agriculture and the Interior

In addition, the framework should provide for the collection and maintenance of data needed to measure program performance. The agencies are developing joint performance measures to monitor progress toward achieving shared program goals. These measures are beginning to be accepted by state, local, and tribal governments as well. As activities required to achieve these joint goals are performed by many parties at different locations, it is important that their performance be measured and reported consistently. The usefulness of these increasingly interagency and intergovernmental performance measures can only be as good as the quality and

consistency of the data collected and reported. To the greatest extent possible, these data should be produced as a by-product of program operations, avoiding the expense and potential unreliability of separate data collection programs. The benefits of improved program evaluation for managing wildland fire, and the necessity for enhanced data and supporting IM systems are discussed in Chapter 6 of the Academy's earlier report, *Managing Wildland Fire: Enhancing Capacity to Implement the Federal Interagency Policy*. Chart 5 illustrates a schematic of the IT/IM framework.

Chart 5. Illustrative Activities Requiring Information Systems Support for Enhancing Wildland Fire Management



Enhanced Computer Models and Decision-Support

A December 2001 report prepared for the Forest Service and Interior National Fire Plan Coordinators, titled *Developing an Interagency, Landscape-scale Fire Planning Analysis and Budget Tool*, recommends integrating the land management agencies' computerized planning, management, and budgeting models to meet land and fire management planning, budgeting, and operations needs. The Panel believes this worthy goal should be pursued so that it produces incremental improvements from year to year under the overall guidance of the Wildland Fire Leadership Council and in accordance with an established IT/IM framework. Some of this model improvement work is underway and should continue.

To facilitate the widespread improvement and use of integrated models, the Wildland Fire Leadership Council should ensure that they compliment each other within the national IT/IM framework, relying on common data inputs and outputs for universal use. This integrated approach should be pursued to save money on data entry and maintenance (usually the most expensive system element), improve the consistency and quality of decision-making across all agencies' wildland fire programs, and consider cost-minimizing alternatives in managing wildland fire programs.

Enhanced Data and Geographic Information Capabilities

Managing wildland fires is very data and information intensive. Along with other activities, the enhanced decision-support models described above depend heavily on the quality of the available data and the ability to display them quickly, efficiently, and effectively.

Geographic information deserves special attention because firefighting is essentially geographic in nature. Fires occur at specific locations where personnel and equipment must be delivered

promptly to manage the fire's progression and extent. Firefighters must always know where they are and where the fire is located.

Geographic data, combined with fire behavior information, can tell the firefighter where the fire is expected to go and how fast. Both of these geographic dimensions are critical to developing strategies, tactics and safety. Even before a fire starts, the geographic areas at risk must be mapped, analyzed, and treated to reduce hazards.

It is essential that everyone involved—individual firefighters, ICs, land managers, fire planners, and non-federal cooperators—have ready access to up-to-date maps and other geographic information that meet agreed-upon standards and formats. Given today's technology, these data should be provided in GIS formats serving multiple needs in rapid response modes that enhance understanding and management of a complex wildfire. The Panel believes that geographic information is so important to efficient and effective fire program management that it deserves a special place in the IT/IM framework and has high priority for widespread deployment.

Recommendation 18. Uniform Data Policies and Standards. **The Panel recommends that the national information technology/information management framework provide for uniform data policies and standards to ensure the interoperability needed among federal, state, and local systems to maximize the utility and maintenance of available geographic information. These policies and standards should be developed in consultation with the parties affected, and compliance with them should be required.**

Rapid Deployment and Use of New Technologies

The Panel found new fire management technology deployment to the field largely decentralized and ad hoc. More often than not, an individual field unit tries something new. If it seems to work, others try it. The new tool may not be well documented, and those trying it early must learn how on the job with little or no assistance. Yet,

trial and error gradually works the bugs out. Training courses are offered, and the new practice is on its way. NWCG working teams sometimes expedite the process.

The Panel believes there are quicker and more efficient ways to develop and deploy new technologies that could more effectively cut costs and avoid losses. Some Forest Service officials have recognized the problem and formulated a proposal to develop a strategic plan to guide the fire and research communities toward effective partnerships in the development, application, and maintenance of wildland fire science and technology. To accomplish this, they proposed creating a permanent R&D planning and technology transfer working group.

Recommendation 19. Technology Transfer Unit. The Panel recommends that the Wildland Fire Leadership Council replace the existing ad hoc approach to technology transfer with a professional interagency unit devoted to getting the fruits of the strategic R&D program into the field more quickly, systematically, and efficiently. The Panel supports the proposed development of a cadre of technology transfer and education professionals.

Results

The Panel believes that implementing these science, technology, and IT/IM recommendations could produce the following results:

- Firefighting technology will be modernized more quickly and systematically, thereby improving productivity.
- IT/IM improvements will enhance the cost-effectiveness of wildland fire management strategies and tactics.
- National databases will become available to support cost analyses and cost-effective program improvements.

Challenges to Key Stakeholders

In pursuing these four initiatives, the Panel recommends a strategic approach that establishes common goals for cost-containment and cost sharing across federal agencies, state, local and tribal governments, and other stakeholders that benefit directly. It will take the combined efforts of them all to achieve the goals of the Federal Wildland Fire Management Policy, the National Fire Plan, and *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment*.

Congress

Congressional leadership is critical to successfully containing wildland fire suppression costs. Congress should set the tone for these efforts by establishing cost containment goals; enacting cost-sharing principles to guide the negotiation of sound intergovernmental agreements for mutual aid and funding of cooperative efforts; and ensuring that the federal land management agencies have adequate planning, budgeting, and management systems, as well as reliable and timely data to analyze large wildland fires and hold responsible officials accountable for suppression cost containment. Congress also should consider legislation to remove roadblocks that delay actions to restore the health of the nation's public lands and to help communities become active partners in risk reduction efforts. In this regard, Congress might call for a thorough review of the planning and environmental laws and regulations governing this process.

Congress should enact a two-part wildfire hazard mitigation incentive program that would operate statewide and in local communities at risk. This program should be closely coordinated with FEMA's disaster mitigation program, which operates at the state and local levels.

The Wildland Fire Leadership Council

The Wildland Fire Leadership Council was established in 2002. It brings together the heads of the five federal land management agencies and other senior officials in the two departments to focus on the agencies' wildland fire programs on a broader policy level and better link them to other land management goals.

The Panel believes this new body has several key roles to play in reaching cost-containment goals. Most important are to keep the Panel's proposed four initiatives moving forward and to hold the agencies accountable for progress. In particular, the Council should provide the foundation for regular post-fire cost reviews and widespread use of lessons learned. Coordinating the highly fragmented science and technology programs also should be high on the Council's list of priorities, along with rolling out the wildfire hazard mitigation incentive program recommended in this report. The Council should continue working closely with the NWCG in all of these efforts.

The Panel believes that leadership challenges continue to grow in this area, and that it would be advantageous to strengthen support for the Council by creating a single, unified interdisciplinary staff that has permanent status. Further, the Council's membership should be expanded to agencies with responsibilities for regulatory and other processes vital to wildland fire program success. The Panel supports recent efforts to expand participation in the Council. However, additional participating agencies might include the Council on Environmental Quality, EPA, and the National Marine Fisheries Service.

Federal Land Management Agencies

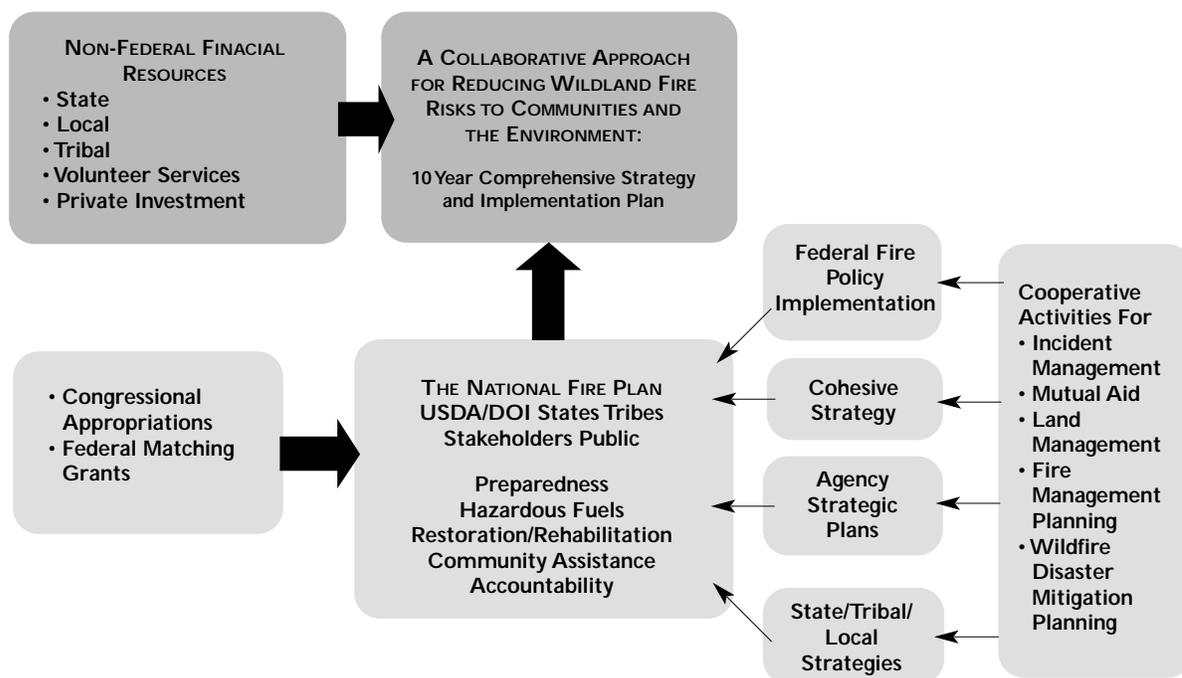
The land management agencies should continue to work more closely with each other and with non-federal stakeholders to produce and implement cross-boundary, landscape-scale natural resource and fire management plans, and community fire-hazard reduction programs. The agencies also should vigorously pursue inter-agency/intergovernmental fire preparedness programs that more fully meet workforce needs and establish agreements for sharing responsibilities and costs for initial and extended attack.

Non-Federal Cooperators

Appropriate and properly trained non-federal cooperators should play a much larger role in future fire suppression, fuels management, and community fire hazard mitigation. They also should take greater responsibility for helping to achieve results and sharing the costs. Local government and fire department roles should become especially important in wildland interface communities.

The Panel believes that federal, state, local, and tribal governments, as well as private and non-profit cooperators, should be in this enterprise together. Fighting large wildfires, reducing fuel hazards, making communities less vulnerable, and taking actions to contain associated costs should not be viewed as an exclusively federal responsibility. These tasks are far too large, complex, and diffuse for any single government or organization to handle alone. Chart 6 illustrates shared wildland fire responsibilities and funding sources.

Chart 6. Stakeholder Relationships for Sharing Broad Wildland Fire Responsibilities



Source: Academy modification of Appendix B, *10 Year Comprehensive Strategy Implementation Plan*, May 2002, p. 24

The Panel realizes that committing to this collaborative effort is a big step. Multiparty enterprises are difficult to operate, requiring different management techniques, greater patience, a willingness to see issues from diverse perspectives, and a mutual commitment to solutions that build on cooperator strengths. However, other intergovernmental programs have demonstrated that such efforts can be successful. The wildland fire community has begun implementing a joint federal, state, local, and tribal effort based on a 10-year Comprehensive Strategy and related Implementation Plan. The

Panel believes this is a step in the right direction that deserves encouragement.

The Panel firmly believes that only a shared effort will produce the desired long-term results, namely reduced wildland fire danger and contained suppression costs.

Summary of Responsibilities

Table 3 summarizes the Panel's recommendations and identifies the parties responsible for implementing each recommendation.

Table 3. Recommendations and Parties Responsible for Implementation

Recommendations	Responsibilities of Major Players			
	Congress	Leadership Council/NWCG	Federal Agencies	Non-Federal Cooperators
Initiative 1. Hazardous Fuels Reduction				
1. Federal agencies work with appropriate parties to examine planning and environmental review processes	<ul style="list-style-type: none"> ■ Authorize review of processes. ■ Potentially take remedial action 	Set common guidelines	Identify and revise problem regulations and processes	Participate in examination process
2. Begin fuels reduction in and near communities		Set common guidelines	Coordinate fuel reduction activities with communities	Coordinate with federal agencies
3. Increase biomass use		Coordinate market aggregation	Participate in collaborative programs	Participate in collaborative programs
4. Broaden investments in fuels programs	Enact hazard mitigation incentive program for fuels reduction in: <ul style="list-style-type: none"> ■ wildlands ■ community interface regions 	<ul style="list-style-type: none"> ■ Establish interagency guidance for coordinated programs ■ Include planning requirements ■ Coordinate with FEMA's DMA program 	<ul style="list-style-type: none"> ■ Administer program collaboratively ■ Assist intergovernmental capacity building 	<ul style="list-style-type: none"> ■ Participate in programs ■ States prepare statewide plan and program ■ Communities prepare local/regional plan and program
Initiative 2. Community Responsibility				
5. Require community hazard mitigation practices, including codes and ordinances		<ul style="list-style-type: none"> ■ Coordinate agency and other efforts ■ Establish guidelines for developing new regulations 	<ul style="list-style-type: none"> ■ Plan and conduct appropriate programs and projects ■ Coordinate and develop community risk reduction regulations 	<ul style="list-style-type: none"> ■ Plan and conduct appropriate programs and projects ■ Provide matching funds ■ Take implementation actions
6. Establish suppression cost-sharing principles	Enact cost-sharing principles	<ul style="list-style-type: none"> ■ Establish interagency guidelines ■ Coordinate with FEMA cost reimbursement program 	Negotiate MOUs consistent with principles and guidelines	<ul style="list-style-type: none"> ■ Negotiate MOUs consistent with principles and guidelines ■ Implement MOUs

Table 3. Recommendations and Parties Responsible for Implementation (continued)

Recommendations	Responsibilities of Major Players			
	Congress	Leadership Council/NWCG	Federal Agencies	Non-Federal Cooperators
Initiative 3. Incident Management Efficiency				
7. Enhance current methods of initial attack resource estimation		Provide project oversight	Continue implementation of inclusive resource estimation model	Offer assistance as needed
8. Develop methodology for analysis of large fire suppression resources		Assign project leadership and provide oversight	Develop methodology and analytical process	
9. Maintain/Improve preparedness and pre-positioning programs	Provide adequate funding	Continue to improve these programs; high inter-agency priority	<ul style="list-style-type: none"> ■ Raise employee expectations of roles in fire ■ Create more Type III teams 	Participate in Type III teams; pre-attack planning; joint exercises
10. Upgrade supply/dispatch system		Provide overall guidance	Improve supply/dispatch processes and systems	Participate in dispatch systems (including local)
11. Enhance incident management strategy selection process		Revise WFSA process; make it more user-friendly	<ul style="list-style-type: none"> ■ Participate in WFSA revision ■ Use WFSA more fully 	<ul style="list-style-type: none"> ■ Participate in WFSA revision ■ Use WFSA more fully
12. Require Incident Business Advisor for Type 1 and 2 fires		Ensure issuance of policy guidance	Train and supply necessary personnel	
13. Develop and deploy a business management software package for use by IMTs (including bar code and smart card technologies)		Provide oversight for project	Complete development of software	
14. Provide flexibility in applying current 14-day rule		Provide oversight for review	Review 14-day policy and provide greater flexibility	
15. Enhance accountability for costs		Issue requirements including criteria for post-fire cost reviews	<ul style="list-style-type: none"> ■ Perform post-fire cost reviews ■ Provide timely cost data 	Participate in cost reviews as appropriate

Table 3. Recommendations and Parties Responsible for Implementation (continued)

Recommendations	Responsibilities of Major Players			
	Congress	Leadership Council/NWCG	Federal Agencies	Non-Federal Cooperators
Initiative 4. Cost Effective Applications of Science, Technology, and Information Management				
16. Establish a user-focused strategic R&D program for wildland fire		<ul style="list-style-type: none"> ■ Direct development of a user-driven strategic plan ■ Oversee IFRCC and JFSP ■ Direct IFRCC outreach to broader science community 	<ul style="list-style-type: none"> ■ Contribute user perspective ■ Perform R&D ■ Contract for R&D 	<ul style="list-style-type: none"> ■ Contribute user perspective ■ Contribute results of own research
17. Enhance information technologies and systems for fire; ensure compatibility of new and enhanced components		<ul style="list-style-type: none"> ■ Establish a comprehensive, interagency/inter governmental information system framework for fire ■ Include common interagency performance measures for fire (and required data) ■ Ensure that key data roll-up into national databases for evaluation 	<ul style="list-style-type: none"> ■ Participate in developing the IT/IM framework and associated standards ■ Follow the framework and standards in equipping and training 	<ul style="list-style-type: none"> ■ Participate in developing the IT/IM framework and associated standards ■ Follow the framework and standards in equipping and training
18. Provide uniform data policies and standards		Provide oversight for policies and standards	Develop data policies and standards	Provide assistance as required
19. Speed deployment and utilization of science & technology advances		<ul style="list-style-type: none"> ■ Establish an integrated model for technology transfer ■ Coordinate, oversee, and monitor interagency R&D deployment 	Deploy advances promptly and consistently	Assist in prompt and consistent deployment

Epilogue 2002

This report focuses on research completed prior to the 2002 fire season. However, the Panel sees the 2002 record-breaking large wildfires as indicators of the increasingly dangerous state of the nation's wildlands and the conditions confronting the fire-fighting community.

The land management agencies have made significant progress under the National Fire Plan. At the beginning of the fire season, they had more than 17,000 full-time fire employees, an increase of 6,300 personnel from FY 2000, to detect and suppress wildfires and plan and execute fuels treatment and other land management programs. They hired additional seasonal staff and crews to achieve quicker response with readily available resources.

As this study came to a close, substantial controversies were forming around the following issues:

- a budget impasse between Congress and the Administration over reimbursing the Forest Service for its suppression costs, resulting in reallocation of much needed funds from other programs
- a realization that modernizing the current fixed wing airtanker fleet is badly behind schedule, and that critical safety problems have grounded over 35 percent of the fleet at various times, even as it is being relied on more
- the appropriate role of wildland closures in preventing fires when risks are high

The Panel did not have an opportunity to study these issues, but believes that they deserve serious and urgent attention.

Progress is being made under the National Fire Plan, and the men and women who comprise the firefighting workforce have provided commendable service. Yet, there had been at least 21 fatalities as of September 24, 2002, as well as several air tanker and helicopter crashes, thousands of homeowners evacuated, hundreds of structures destroyed, more than 6,400,000 acres burned (more than during 2001), and more than \$1.2 billion spent to suppress wildfires. The agencies estimated that final FY 2002 suppression expenditures could exceed \$1.5 billion, an all-time high.

Figure 11 (on page 25) shows the locations of all the large wildfires in 2002, as of September 20. Analysis indicates that approximately 95 percent occurred on lands with hazardous fuels conditions. Figure 12 (on page 32) shows the close relationship between the large fires in 2002 and hazardous fuel conditions.

These fires strongly reinforce the concern that drought, excessive fuel hazards, and human movement into the wildlands continue to threaten the nation's communities, forests and fields, driving costs even higher. The 2002 fire season is more than a wake-up call. It is a painful reminder of the magnitude of the problem and the dire need for action.

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