United States Government Accountability Office

GAO

Testimony

Before the Subcommittee on Public Lands and Forests, Committee on Energy and Natural Resources, U.S. Senate

For Release on Delivery
Expected at 2:30 p.m. EDT
Tuesday, April 26, 2005

WILDLAND FIRE MANAGEMENT

Progress and Future Challenges, Protecting Structures, and Improving Communications

Statement of Robin M. Nazzaro, Director
Natural Resources and Environment

April 26, 2005

WILDLAND FIRE MANAGEMENT

Progress and Future Challenges, Protecting Structures, and Improving Communications

GAO Accountability•Integrity•Reliability

Highlights

Highlights of GAO-05-627T, a testimony before the Subcommittee on Public Lands and Forests, Committee on Energy and Natural Resources, U.S.Senate

Why GAO Did This Study

Wildland fires are increasingly threatening communities and ecosystems. In recent years, they have become more intense due to excess vegetation that has accumulated, partly as a result of past suppression efforts. The cost to suppress these fires is increasing and, as more people move into fire-prone areas near wildlands, the number of homes at risk is growing. During these wildland fires, effective communications among the public safety agencies responding from various areas is critical, but can be hampered by incompatible radio equipment.

This testimony discusses (1) progress made and future challenges to managing wildland fire, (2) measures to help protect structures, and (3) the role of technology in improving responder communications during fires. It is based on two GAO reports: *Wildland Fire Management: Important Progress Has Been Made, but Challenges Remain to Completing a Cohesive Strategy* (GAO-05-147, Jan. 14, 2005) and *Technology Assessment: Protecting Structures and Improving Communications during Wildland Fires* (GAO-05-380, Apr. 26, 2005).

What GAO Recommends

In its report, GAO recommended that the Departments of Agriculture and the Interior develop a plan for completing a cohesive strategy that identifies options and funding needed to address wildland fire problems. The departments agreed.

www.gao.gov/cgi-bin/getrpt?GAO-05-627T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin M. Nazzaro at (202) 512-3841 or nazzaror@gao.gov.

What GAO Found

Over the last 5 years, the Forest Service in the Department of Agriculture and land management agencies in the Department of the Interior, working with the Congress, have made important progress in responding to wildland fires. Most notably, the agencies have adopted various national strategy documents addressing the need to reduce wildland fire risks, established a priority to protect communities in the wildland-urban interface, and increased efforts and amounts of funding committed to addressing wildland fire problems. However, despite producing numerous planning and strategy documents, the agencies have yet to develop a cohesive strategy that identifies the long-term options and related funding needed to reduce excess vegetation that fuels fires in national forests and rangelands. Reducing these fuels lowers risks to communities and ecosystems and helps contain suppression costs. As GAO noted in 1999, such a strategy would help the agencies and the Congress to determine the most effective and affordable long-term approach for addressing wildland fire problems. Completing this strategy will require finishing several efforts now under way to improve a key wildland fire data and modeling system, local fire management planning, and a new system designed to identify the most cost-effective means for allocating fire management budget resources, each of which has its own challenges. Without completing these tasks, the agencies will have difficulty determining the extent and location of wildland fire threats, targeting and coordinating their efforts and resources, and resolving wildland fire problems in the most timely and cost-effective manner over the long term.

The two most effective measures for protecting structures from wildland fires are (1) creating and maintaining a buffer around a structure by eliminating or reducing trees, shrubs, and other flammable objects within an area from 30 to 100 feet around the structure and (2) using fire-resistant roofs and vents. Other technologies—such as fire-resistant building materials, chemical agents, and geographic information system mapping tools—can help in protecting structures and communities, but they play a secondary role. Many homeowners, however, are not using the protective measures because of the time or expense involved, competing values or concerns, misperceptions about wildland fires, or lack of awareness of their shared responsibility for home protection. Federal, state, and local governments and others are attempting to address this problem through a variety of educational, financial assistance, and regulatory efforts.

Technologies exist and others are being developed to address communications problems among emergency responders using different radio frequencies or equipment. However, technology alone cannot solve this problem. Effective adoption of these technologies requires planning and coordination among federal, state, and local agencies involved. The Department of Homeland Security, as well as several states and local jurisdictions, are pursuing initiatives to improve communications.

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to discuss two GAO reports that reviewed several wildland fire issues—one issued in January 2005 that reviews the status of the federal government's efforts to address our nation's wildland fire problems and another, being released today, that discusses ways to help protect homes and improve communications during such fires. Each report is presented separately below.

Wildland fire is a natural process that plays an important role in the health of many fire-adapted ecosystems, but it also can cause catastrophic damages to communities and ecosystems. The trend of increasing wildland fire threats to communities and ecosystems that we reported on 5 years ago has been continuing. The average acreage of lands burned by wildland fires annually from 2000 through 2003 was 56 percent greater than the average amount burned annually during the 1990s. Also, since 2000, wildland fires have burned an average of 1,100 homes each year in the United States, according to the National Fire Protection Association. In 2003 alone, more than 3,600 homes were destroyed by wildland fires in Southern California and resulted in more than $2 billion in insured losses. Experts believe that catastrophic damages from wildland fires probably will continue to increase until an adequate long-term federal response, coordinated with other levels of government, is implemented and individuals living in at-risk areas take preventive measures to protect their homes from wildland fires.

WILDLAND FIRE MANAGEMENT: Forest Service and Interior Need to Specify Steps and a Schedule for Identifying Long-Term Options and Their Costs

First, let me summarize the findings of GAO's January 2005 report that discusses the progress the federal government has made over the last 5 years and key challenges it faces in developing and implementing a long-term response to wildland fire problems.[1] This report is based primarily on over 25 reviews we conducted in recent years of federal wildland fire management that focused largely on the activities of the Forest Service in the Department of Agriculture and the land management agencies in the Department of the Interior, which together manage about 95 percent of all federal lands.

[1]GAO, *Wildland Fire Management: Important Progress Has Been Made, but Challenges Remain to Completing a Cohesive Strategy*, GAO-05-147 (Washington, D.C.: Jan. 14, 2005).

Summary

In the past 5 years, the federal government has made important progress in putting into place the basic components of a framework for managing and responding to the nation's wildland fire problems, including

- establishing a priority to protect communities near wildlands—called the wildland-urban interface;
- increasing the amount of effort and funds available for addressing fire-related concerns, such as fuel reduction on federal lands;
- improving data and research on wildland fire, local fire management plans, interagency coordination, and collaboration with nonfederal partners; and
- refining performance measures and results monitoring for wildland fire management.

While this progress has been important, many challenges remain for addressing wildland fire problems in a timely and effective manner. Most notably, the land management agencies need to complete a cohesive strategy that identifies the long-term options and related funding needed for reducing fuels and responding to wildland fires when they occur. A recent Western Governors' Association report also called for completing such a cohesive federal strategy. The agencies and the Congress need such a strategy to make decisions about an effective and affordable long-term approach for addressing problems that have been decades in the making and will take decades more to resolve. However, completing and implementing such a strategy will require that the agencies complete several challenging tasks, including

- developing data systems needed to identify the extent, severity, and location of wildland fire threats to the nation's communities and ecosystems;
- updating local fire management plans to better specify the actions needed to effectively address these threats; and
- assessing the cost-effectiveness and affordability of options for reducing fuels.

In our January 2005 report, we recommended that the Secretaries of Agriculture and the Interior provide the Congress, in time for its consideration of the agencies' fiscal year 2006 wildland fire management budgets, with a joint tactical plan outlining the critical steps the agencies

will take, together with related time frames, to complete a cohesive strategy that identifies long-term options and needed funding for reducing and maintaining fuels at acceptable levels and responding to the nation's wildland fire problems. The Departments of Agriculture and the Interior have said that they will produce such a joint tactical plan by August 2005.

Background

Wildland fire triggered by lightning is a normal, inevitable, and necessary ecological process that nature uses to periodically remove excess undergrowth, small trees, and vegetation to renew ecosystem productivity. However, various human land use and management practices, including several decades of fire suppression activities, have reduced the normal frequency of wildland fires in many forest and rangeland ecosystems and have resulted in abnormally dense and continuous accumulations of vegetation that can fuel uncharacteristically large and intense wildland fires. Such large intense fires increasingly threaten catastrophic ecosystem damage and also increasingly threaten human lives, health, property, and infrastructure in the wildland-urban interface. Federal researchers estimate that vegetative conditions that can fuel such fires exist on approximately 190 million acres—or more than 40 percent—of federal lands in the contiguous United States but could vary from 90 million to 200 million acres, and that these conditions also exist on many nonfederal lands.

Our reviews over the last 5 years identified several weaknesses in the federal government's management response to wildland fire issues. These weaknesses included the lack of a national strategy that addressed the likely high costs of needed fuel reduction efforts and the need to prioritize these efforts. Our reviews also found shortcomings in federal implementation at the local level, where over half of all federal land management units' fire management plans did not meet agency requirements designed to restore fire's natural role in ecosystems consistent with human health and safety. These plans are intended to identify needed local fuel reduction, preparedness, suppression, and rehabilitation actions. The agencies also lacked basic data, such as the amount and location of lands needing fuel reduction, and research on the effectiveness of different fuel reduction methods on which to base their fire management plans and specific project decisions. Furthermore, coordination among federal agencies and collaboration between these agencies and nonfederal entities were ineffective. This kind of cooperation is needed because wildland fire is a shared problem that transcends land ownership and administrative boundaries. Finally, we found that better accountability for federal expenditures and performance in wildland fire

management was needed. Agencies were unable to assess the extent to which they were reducing wildland fire risks or to establish meaningful fuel reduction performance measures, as well as to determine the cost-effectiveness of these efforts, because they lacked both monitoring data and sufficient data on the location of lands at high risk of catastrophic fires to know the effects of their actions. As a result, their performance measures created incentives to reduce fuels on all acres, as opposed to focusing on high-risk acres.

Because of these weaknesses, and because experts said that wildland fire problems could take decades to resolve, we said that a cohesive, long-term, federal wildland fire management strategy was needed.[2] We said that this cohesive strategy needed to focus on identifying options for reducing fuels over the long term in order to decrease future wildland fire risks and related costs. We also said that the strategy should identify the costs associated with those different fuel reduction options over time, so that the Congress could make cost-effective, strategic funding decisions.

Important Progress Has Been Made in Addressing Federal Wildland Fire Management Problems over the Last 5 Years

The federal government has made important progress over the last 5 years in improving its management of wildland fire. Nationally it has established strategic priorities and increased resources for implementing these priorities. Locally, it has enhanced data and research, planning, coordination, and collaboration with other parties. With regard to accountability, it has improved performance measures and established a monitoring framework.

Progress in National Strategy: Priorities Have Been Clarified and Funding Has Been Increased for Identified Needs

Over the last 5 years, the federal government has been formulating a national strategy known as the National Fire Plan, composed of several strategic documents that set forth a priority to reduce wildland fire risks to communities. Similarly, the recently enacted Healthy Forests Restoration Act of 2003 directs that at least 50 percent of funding for fuel reduction projects authorized under the act be allocated to wildland-urban interface areas. While we have raised concerns about the way the agencies have

[2]GAO, *Western National Forests: A Cohesive Strategy Is Needed to Address Catastrophic Wildfire Threats*. GAO/RCED-99-65. Washington, D.C.: Apr. 2, 1999.

defined these areas and the specificity of their prioritization guidance, we believe that the act's clarification of the community protection priority provides a good starting point for identifying and prioritizing funding needs. Similarly, in contrast to fiscal year 1999, when we reported that the Forest Service had not requested increased funding to meet the growing fuel reduction needs it had identified, fuel reduction funding for both the Forest Service and Interior quadrupled by fiscal year 2004. The Congress, in the Healthy Forests Restoration Act, also authorized $760 million per year to be appropriated for hazardous fuels reduction activities, including projects for reducing fuels on up to 20 million acres of land. Moreover, appropriations for both agencies' overall wildland fire management activities, including preparedness, suppression, and rehabilitation, have nearly tripled, from about $1 billion in fiscal year 1999 to over $2.7 billion in fiscal year 2004.

Progress in Local Implementation: Data and Research, Fire Management Planning, and Coordination and Collaboration Have Been Strengthened

The agencies have strengthened local wildland fire management implementation by making significant improvements in federal data and research on wildland fire over the past 5 years, including an initial mapping of fuel hazards nationwide. Additionally, in 2003, the agencies approved funding for development of a geospatial data and modeling system, called LANDFIRE, to map wildland fire hazards with greater precision and uniformity. LANDFIRE—estimated to cost $40 million and scheduled for nationwide implementation in 2009—will enable comparisons of conditions between different field locations nationwide, thus permitting better identification of the nature and magnitude of wildland fire risks confronting different community and ecosystem resources, such as residential and commercial structures, species habitat, air and water quality, and soils.

The agencies also have improved local fire management planning by adopting and executing an expedited schedule to complete plans for all land units that had not been in compliance with agency requirements. The agencies also adopted a common interagency template for preparing plans to ensure greater consistency in their contents.

Coordination among federal agencies and their collaboration with nonfederal partners, critical to effective implementation at the local level, also has been improved. In 2001, as a result of congressional direction, the agencies jointly formulated a 10-Year Comprehensive Strategy with the Western Governors' Association to involve the states as full partners in their efforts. An implementation plan adopted by the agencies in 2002 details goals, time lines, and responsibilities of the different parties for a

wide range of activities, including collaboration at the local level to identify fuel reduction priorities in different areas. Also in 2002, the agencies established an interagency body, the Wildland Fire Leadership Council, composed of senior Agriculture and Interior officials and nonfederal representatives, to improve coordination of their activities with each other and nonfederal parties.

Progress in Accountability: Better Performance Measures and a Results Monitoring Framework Have Been Developed

Accountability for the results the federal government achieves from its investments in wildland fire management activities also has been strengthened. The agencies have adopted a performance measure that identifies the amount of acres moved from high-hazard to low-hazard fuel conditions, replacing a performance measure for fuel reductions that measured only the total acres of fuel reductions and created an incentive to treat less costly acres rather than the acres that presented the greatest hazards. Additionally, in 2004, to have a better baseline for measuring progress, the Wildland Fire Leadership Council approved a nationwide framework for monitoring the effects of wildland fire. While an implementation plan is still needed for this framework, it nonetheless represents a critical step toward enhancing wildland fire management accountability.

Agencies Face Several Challenges to Completing a Long-Needed Cohesive Strategy for Reducing Fuels and Responding to Wildland Fire Problems

While the federal government has made important progress over the past 5 years in addressing wildland fire, a number of challenges still must be met to complete development of a cohesive strategy that explicitly identifies available long-term options and funding needed to reduce fuels on the nation's forests and rangelands. Without such a strategy, the Congress will not have an informed understanding of when, how, and at what cost wildland fire problems can be brought under control. None of the strategic documents adopted by the agencies to date have identified these options and related funding needs, and the agencies have yet to delineate a plan or schedule for doing so. To identify these options and funding needs, the agencies will have to address several challenging tasks related to their data systems, fire management plans, and assessing the cost-effectiveness and affordability of different options for reducing fuels.

Completing and Implementing the LANDFIRE System Is Essential to Identifying and Addressing Wildland Fire Threats

The agencies face several challenges to completing and implementing LANDFIRE, so that they can more precisely identify the extent and location of wildland fire threats and better target fuel reduction efforts. These challenges include using LANDFIRE to better reconcile the effects of fuel reduction activities with the agencies' other stewardship responsibilities for protecting ecosystem resources, such as air, water, soils, and species habitat, which fuel reduction efforts can adversely affect. The agencies also need LANDFIRE to help them better measure and assess their performance. For example, the data produced by LANDFIRE will help them devise a separate performance measure for maintaining conditions on low-hazard lands to ensure that their conditions do not deteriorate to more hazardous conditions while funding is being focused on lands with high-hazard conditions.

In implementing LANDFIRE, however, the agencies will have to overcome the challenges presented by the current lack of a consistent approach to assessing the risks of wildland fires to ecosystem resources as well as the lack of an integrated, strategic, and unified approach to managing and using information systems and data, including those such as LANDFIRE, in wildland fire decision making. Currently, software, data standards, equipment, and training vary among the agencies and field units in ways that hamper needed sharing and consistent application of the data. Also, LANDFIRE data and models may need to be revised to take into account recent research findings that suggest part of the increase in wildland fire in recent years has been caused by a shift in climate patterns. This research also suggests that these new climate patterns may continue for decades, resulting in further increases in the amount of wildland fire. Thus, the nature, extent, and geographical distribution of hazards initially identified in LANDFIRE, as well as the costs for addressing them, may have to be reassessed.

Fire Management Plans Will Need to Be Updated with Latest Data and Research on Wildland Fire

The agencies will need to update their local fire management plans when more detailed, nationally consistent LANDFIRE data become available. The plans also will have to be updated to incorporate recent agency fire research on approaches to more effectively address wildland fire threats. For example, a 2002 interagency analysis found that protecting wildland-urban interface communities more effectively—as well as more cost-effectively—might require locating a higher proportion of fuel reduction projects outside of the wildland-urban interface than currently envisioned, so that fires originating in the wildlands do not become too large to suppress by the time they arrive at the interface. Moreover, other agency research suggests that placing fuel reduction treatments in specific

geometric patterns may, for the same cost, provide protection for up to three times as many community and ecosystem resources as do other approaches, such as placing fuel breaks around communities and ecosystems resources. Timely updating of fire management plans with the latest research findings on optimal design and location of treatments also will be critical to the effectiveness and cost-effectiveness of these plans. The Forest Service indicated that this updating could occur during annual reviews of fire management plans to determine whether any changes to them may be needed.

Ongoing Efforts to Assess the Cost-Effectiveness and Affordability of Fuel Reduction Options Need to Be Completed

Completing the LANDFIRE data and modeling system and updating fire management plans should enable the agencies to formulate a range of options for reducing fuels. However, to identify optimal and affordable choices among these options, the agencies will have to complete certain cost-effectiveness analysis efforts they currently have under way. These efforts include an initial 2002 interagency analysis of options and costs for reducing fuels, congressionally-directed improvements to their budget allocation systems, and a new strategic analysis framework that considers affordability.

The Interagency Analysis of Options and Costs: In 2002, a team of Forest Service and Interior experts produced an estimate of the funds needed to implement eight different fuel reduction options for protecting communities and ecosystems across the nation over the next century. Their analysis also considered the impacts of fuels reduction activities on future costs for other principal wildland fire management activities, such as preparedness, suppression, and rehabilitation, if fuels were not reduced. The team concluded that the option that would result in reducing the risks to communities and ecosystems across the nation could require an approximate tripling of current fuel reduction funding to about $1.4 billion for an initial period of a few years. These initially higher costs would decline after fuels had been reduced enough to use less expensive controlled burning methods in many areas and more fires could be suppressed at lower cost, with total wildland fire management costs, as well as risks, being reduced after 15 years. Alternatively, the team said that not making a substantial short-term investment using a landscape focus could increase both costs and risks to communities and ecosystems in the long term. More recently, however, Interior has said that the costs and time required to reverse current increasing risks may be less when other vegetation management activities—such as timber harvesting and habitat improvements—are considered that were not included in the interagency team's original assessment but also can influence wildland fire.

The cost of the 2002 interagency team's option that reduced risks to communities and ecosystems over the long term is consistent with a June 2002 National Association of State Foresters' projection of the funding needed to implement the 10-Year Comprehensive Strategy developed by the agencies and the Western Governors' Association the previous year. The state foresters projected a need for steady increases in fuel reduction funding up to a level of about $1.1 billion by fiscal year 2011. This is somewhat less than that of the interagency team's estimate, but still about 2-1/2 times current levels.

The interagency team of experts who prepared the 2002 analysis of options and associated costs said their estimates of long-term costs could only be considered an approximation because the data used for their national-level analysis were not sufficiently detailed. They said a more accurate estimate of the long-term federal costs and consequences of different options nationwide would require applying this national analysis framework in smaller geographic areas using more detailed data, such as that produced by LANDFIRE, and then aggregating these smaller-scale results.

The New Budget Allocation System: Agency officials told us that a tool for applying this interagency analysis at a smaller geographic scale for aggregation nationally may be another management system under development—the Fire Program Analysis system. This system, being developed in response to congressional committee direction to improve budget allocation tools, is designed to identify the most cost-effective allocations of annual preparedness funding for implementing agency field units' local fire management plans. Eventually, the Fire Program Analysis system, being initially implemented in 2005, will use LANDFIRE data and provide a smaller geographical scale for analyses of fuel reduction options and thus, like LANDFIRE, will be critical for updating fire management plans. Officials said that this preparedness budget allocation system—when integrated with an additional component now being considered for allocating annual fuel reduction funding—could be instrumental in identifying the most cost-effective long-term levels, mixes, and scheduling of these two wildland fire management activities. Completely developing the Fire Program Analysis system, including the fuel reduction funding component, is expected to cost about $40 million and take until at least 2007 and perhaps until 2009.

The New Strategic Analysis Effort: In May 2004, Agriculture and Interior began the initial phase of a wildland fire strategic planning effort that also might contribute to identifying long-term options and needed funding for

reducing fuels and responding to the nation's wildland fire problems. This effort—the Quadrennial Fire and Fuels Review—is intended to result in an overall federal interagency strategic planning document for wildland fire management and risk reduction and to provide a blueprint for developing affordable and integrated fire preparedness, fuels reduction, and fire suppression programs. Because of this effort's consideration of affordability, it may provide a useful framework for developing a cohesive strategy that includes identifying long-term options and related funding needs. The preliminary planning, analysis, and internal review phases of this effort are currently being completed and an initial report is expected in 2005.

The improvements in data, modeling, and fire behavior research that the agencies have under way, together with the new cost-effectiveness focus of the Fire Program Analysis system to support local fire management plans, represent important tools that the agencies can begin to use now to provide the Congress with initial and successively more accurate assessments of long-term fuel reduction options and related funding needs. Moreover, a more transparent process of interagency analysis in framing these options and their costs will permit better identification and resolution of differing assumptions, approaches, and values. This transparency provides the best assurance of accuracy and consensus among differing estimates, such as those of the interagency team and the National Association of State Foresters.

A Recent Western Governors' Association Report Is Consistent with GAO's Findings and Recommendation

In November 2004, the Western Governors' Association issued a report prepared by its Forest Health Advisory Committee that assessed implementation of the 10-Year Comprehensive Strategy, which the association had jointly devised with the agencies in 2001.[3] Although the association's report had a different scope than our review, its findings and recommendations are, nonetheless, generally consistent with ours about the progress made by the federal government and the challenges it faces over the next 5 years. In particular, it recommends, as we do, completion of a long-term federal cohesive strategy for reducing fuels. It also cites the need for continued efforts to improve, among other things, data on hazardous fuels, fire management plans, the Fire Program Analysis system,

[3]*Report to the Western Governors on the Implementation of the 10-Year Comprehensive Strategy*, Western Governors' Association Forest Health Advisory Committee (Denver, Colo.: 2004).

and cost-effectiveness in fuel reductions—all challenges we have emphasized today.

Conclusions

The progress made by the federal government over the last 5 years has provided a sound foundation for addressing the problems that wildland fire will increasingly present to communities, ecosystems, and federal budgetary resources over the next few years and decades. But, as yet, there is no clear single answer about how best to address these problems in either the short or long term. Instead, there are different options, each needing further development to understand the trade-offs among the risks and funding involved. The Congress needs to understand these options and trade-offs in order to make informed policy and appropriations decisions on this 21st century challenge.

This is the same message we provided in 1999 when we first called for development of a cohesive strategy identifying options and funding needs. But it still has not been completed. While the agencies are now in a better position to do so, they must build on the progress made to date by completing data and modeling efforts underway, updating their fire management plans with the results of these data efforts and ongoing research, and following through on recent cost-effectiveness and affordability initiatives. However, time is running out. Further delay in completing a strategy that cohesively integrates these activities to identify options and related funding needs will only result in increased long-term risks to communities, ecosystems, and federal budgetary resources.

Because there is an increasingly urgent need for a cohesive federal strategy that identifies long-term options and related funding needs for reducing fuels, we have recommended that the Secretaries of Agriculture and the Interior provide the Congress, in time for its consideration of the agencies' fiscal year 2006 wildland fire management budgets, with a joint tactical plan outlining the critical steps the agencies will take, together with related time frames, to complete such a cohesive strategy.

In an April 2005 letter, Agriculture and Interior said that they will produce by August 2005, for the Wildland Fire Leadership Council's review and approval, a .joint tactical plan that will identify the steps and time frames for developing a cohesive strategy.

WILDLAND FIRE: Protecting Structures and Improving Communications

Next, I would like to summarize the findings of our second report, being released today, that discusses ways to help protect homes and improve communications during wildland fires. Although wildland fire is a natural process that plays an important role in the health of many fire-adapted ecosystems, it has the potential to damage or destroy homes located in or near these wildlands, in the area commonly called the wildland-urban interface. Since 1984, wildland fires have burned an average of 850 homes each year in the United States, according to the National Fire Protection Association. However, losses since 2000 have risen to an average of 1,100 homes annually. In 2003, more than 3,600 homes were destroyed by wildland fires in Southern California and resulted in more than $2 billion in insured losses.

Many homes are located in the wildland-urban interface nationwide, and the number is growing, although the risk to these homes from wildland fire varies widely. In California, for example, an estimated 4.9 million of the state's 12 million housing units are located in or near the wildlands, and 3.2 million of these are at significant risk from wildland fire.[4] As people continue to move to areas in or near fire-prone wildlands, the number of homes at risk from wildland fire is likely to grow. When a large high-intensity wildland fire occurs near inhabited areas, it can threaten hundreds of homes at the same time and overwhelm available firefighting resources. Homeowners can play an important role in protecting their homes from a wildland fire, however, by taking preventive steps to reduce their home's ignition potential. These preventive measures can significantly improve a home's chance of surviving a wildland fire, even without intervention by firefighting agencies.

Once a wildland fire starts, many different agencies may assist in the efforts to manage or suppress it, including the Forest Service (within the Department of Agriculture); land management agencies in the Department of the Interior; state forestry agencies; local fire departments; private contract firefighting crews; and, in some cases, the military. Effective communications among responders—commonly called communications interoperability—is essential to fighting wildland fires successfully and ensuring both firefighter and public safety. Communications interoperability can be hampered because the various agencies responding

[4]California Department of Forestry and Fire Protection, *The Changing California: Forest and Range 2003 Assessment* (Sacramento, Calif.: 2003).

to a fire may communicate over different radio frequency bands or with incompatible communications equipment.

My testimony today summarizes key findings from our report released today[5] and addresses: (1) measures that can help protect structures from wildland fires, (2) factors affecting the use of these protective measures, and (3) the role that technology plays in improving firefighting agencies' ability to communicate during wildland fires.[6]

Summary

In summary, we found the following:

- The two most effective measures for protecting structures from wildland fires are: (1) creating and maintaining a buffer around a structure—often called defensible space—by eliminating or reducing trees, shrubs, and other flammable objects within an area from 30 to 100 feet around the structure and (2) using fire-resistant roofs and vents. Other technologies, such as fire-resistant windows and building materials, sprinkler systems, and chemical agents (gels and foams) that coat structures with a temporary protective layer can also help protect structures, but they play a secondary role. In addition, technologies, such as geographic information systems (GIS) are available or under development to assist in fire protection at the community level.

- Although protective measures are effective and available, many homeowners do not use them for four main reasons: time or expense involved, competing values or concerns, misperceptions about wildland fires, and lack of awareness of homeowners' shared responsibility for home protection. Federal, state, and local government agencies and nongovernmental organizations are taking steps to increase the use of protective measures through education, financial or direct assistance, and adoption and enforcement of laws requiring defensible space around structures and the use of fire-resistant building materials.

- A variety of technologies exist, and others are being developed, to aid communications interoperability between emergency responders, including firefighters, but technology alone cannot solve this problem. In

[5]GAO, *Technology Assessment: Protecting Structures and Improving Communications during Wildland Fires*, GAO-05-380 (Washington, D.C.: Apr. 26, 2005).

[6]Our report also includes information on the use of military resources for wildland firefighting.

the short-term, patchwork interoperability technologies, such as audio switches, can be used to link communication systems using different radio frequencies or equipment. In the long-term, technologies are available or under development to upgrade communications systems to provide increased interoperability. Effective adoption of any of these technologies, however, requires planning and coordination among federal, state, and local agencies that work together to respond to wildland fires and other emergencies.

Background

To understand how preventive steps can help protect homes from wildland fire requires an understanding of what wildland fire is, how it spreads, and how it can threaten homes. Fire requires three elements—oxygen, heat, and fuel—to ignite and continue burning. Once a fire has begun, a number of factors—including weather conditions and the type of nearby vegetation or other fuels—influence how fast and how intensely the fire spreads. Any combustible object in a fire's path, including homes, can fuel a wildland fire. In fact, homes can sometimes be more flammable than the trees, shrubs, or other vegetation surrounding them. If any one of the three required elements are removed, however, such as when firefighters remove vegetation and other fuels from a strip of land near a fire—called a fire break—a fire will normally become less intense and eventually die out.

Wildland fire can threaten homes or other structures in the following ways:

- *Surface fires* burn vegetation or other fuels near the surface of the ground, such as shrubs, fallen leaves, small branches, and roots. These fires can ignite a home by burning nearby vegetation and eventually igniting flammable portions of the home, including exterior walls or siding; attached structures, such as a fence or deck; or other flammable materials, such as firewood or patio furniture.

- *Crown fires* burn the tops, or crowns, of trees. Crown fires normally begin as surface fires and move up the trees by burning "ladder fuel," such as nearby shrubs or low tree branches. Crown fires create intense heat and if close enough—within approximately 100 feet—can ignite portions of structures even without direct contact from flames.

- *Spot fires* are started by embers, or "firebrands," that can be carried a mile or more away from the main fire, depending on wind conditions. Firebrands can ignite a structure by landing on the roof or by entering a vent or other opening and may accumulate on or near homes.

Firebrands can start many new spot fires or ignite many homes simultaneously, increasing the complexity of firefighting efforts.

Recognizing that during severe wildland fires, suppression efforts alone cannot protect all homes threatened by wildland fire, firefighting and community officials are increasing their emphasis on preventive approaches that help reduce the chance that wildland fires will ignite homes and other structures. Because the vast majority of structures damaged or destroyed by wildland fires are located on private property, the primary responsibility for taking adequate steps to minimize or prevent damage from a wildland fire rests with the property owner and with state and local governments that can establish building requirements and land-use restrictions.

When a wildland fire occurs, personnel from firefighting and other emergency agencies responding to it primarily use land mobile radio systems for communications. These systems include mobile radios in vehicles and handheld portable radios and operate using radio signals, which travel through space in the form of waves. These waves vary in length, and each wavelength is associated with a particular radio frequency.[7] Radio frequencies are grouped into bands. Of the more than 450 frequency bands in the radio spectrum, 10, scattered across the spectrum, are allocated to public safety agencies. A firefighting or public safety agency typically uses a radio frequency band appropriate for its locale, either rural or urban. Bands at the lower end of the radio spectrum, such as VHF (very high frequency), work well in rural areas where radio signals can travel long distances without obstruction from buildings or other structures. Federal firefighting agencies, such as the Forest Service, and many state firefighting agencies operate radios in the VHF band. In urban areas, firefighting and other public safety agencies may operate radios on higher frequencies, such as those in the UHF (ultrahigh frequency) or 800 MHz bands, because these frequencies can provide better communications capabilities for an urban setting. When federal, state, and local emergency response agencies work together, for example to fight a fire in the wildland-urban interface, they may not be able to communicate with one another because they operate in different bands along the radio frequency spectrum.

[7]Radio frequencies are measured in Hertz (Hz); the term *kilohertz* (kHz) refers to thousands of Hertz, *megahertz* (MHz) to millions of Hertz, and *gigahertz (*GHz) to billions of Hertz.

Defensible Space and Fire-Resistant Roofs and Vents Are Key to Protecting Structures; Other Technologies Can Also Help

Managing vegetation and reducing or eliminating flammable objects—often called defensible space—within 30 to 100 feet of a structure is a key protective measure. Creating such defensible space offers protection by breaking up continuous fuels that could otherwise allow a surface fire to contact and ignite a structure. Defensible space also offers protection against crown fires. Reducing the density of large trees around structures decreases the intensity of heat from a fire, thus preventing or reducing the chance of ignition and damage to structures. Analysis of homes burned during wildland fires has shown defensible space to be a key determinant of whether a home survives. For instance, the 1981 Atlas Peak Fire in California damaged or destroyed 91out of 111 structures that lacked adequate defensible space but only 5 structures out of 111 that had it.

The use of fire-resistant roofs and vents is also important in protecting structures from wildland fires. Many structures are damaged or destroyed by firebrands that can travel a mile or more from the main fire. Firebrands can land on a roof or enter a home through an opening, such as an attic vent and ignite a home hours after the fire has passed. Fire-resistant roofing materials can reduce the risk that these firebrands will ignite a roof, and vents can be screened with mesh to prevent firebrands from entering and igniting attics. Combining fire-resistant roofs and vents with the creation of defensible space is particularly effective, because together these measures reduce the risk from surface fires, crown fires, and firebrands.

Other technologies can also help protect individual structures from wildland fires.

- *Fire-resistant windows* constructed of double-paned glass, tempered glass, or glass block help protect a structure from wildland fire by reducing the risk of the window breaking and allowing fire to enter the structure.

- *Fire-resistant building materials*—such as fiber-cement, brick, stone, metal, and stucco—can be used for walls, siding, decks, and doors to help prevent ignition and subsequent damage from wildland fire.

- *Chemical agents*, such as foams and gels, are temporary protective measures that can be applied as an exterior coating shortly before a wildland fire reaches a structure. Although these agents have successfully been used to protect homes, such as during the Southern California fires in 2003, they require that someone be available to apply

them and, possibly, reapply or rewet them to ensure they remain effective. They can also be difficult to clean up.

- *Sprinkler systems*, which can be installed inside or outside a structure, lower the risk of ignition or damage from wildland fires. Sprinklers, however, require reliable sources of water and, in some cases, electricity to be effective. According to firefighting officials, adequate water and electricity may not be available during a wildland fire.

In addition to technologies aimed at protecting individual structures, technologies also exist or are being developed which can help reduce the risk of wildland fire damage to an entire community.

- *GIS* is a computer-based information system that can be used to efficiently store, analyze, and display multiple forms of information on a single map.[8] GIS technologies allow fire officials and local and regional land managers to combine vegetation, fuel, and topography data into separate layers of a single GIS map to identify and prioritize areas needing vegetation management. State and county officials we met with emphasized the value of GIS in community-planning efforts to protect structures and communities from wildland fire damage within their jurisdictions.

- *Fire behavior modeling* has been used to predict wildland fire behavior, but these models do not accurately predict fire behavior in the wildland-urban interface. Existing models can help identify areas likely to experience intense wildland fires, identify suitable locations for vegetation management, predict the effect of vegetation treatments on fire behavior, and aid suppression by predicting the overall behavior of a given fire. These models do not, however, consider the effect that structures and landscaping have on wildland fire behavior.

- *Automated detection systems* use infrared, ultraviolet, or temperature-sensitive sensors[9] placed around a community, or an individual home, to detect the presence of a wildland fire. On detecting a fire, a sensor could set off an audible alarm or could be connected via radio or satellite to a device that would notify homeowners or emergency personnel. Several

[8]For additional information on how GIS can assist wildland fire management, see: GAO, *Geospatial Information: Technologies Hold Promise for Wildland Fire Management, but Challenges Remain*, GAO-03-1047 (Washington, D.C.: Sept. 23, 2003).

[9]Infrared and ultraviolet technologies sense the electromagnetic radiation from a fire outside the visible band that humans can see. Temperature sensitive devices, such as heat sensitive resistant wires, do not sense radiation but react to temperature differentials.

such sensors could be networked together to provide broad coverage of the area surrounding a community. According to fire officials, sensor systems may prove particularly helpful in protecting communities in areas of rugged terrain or poor access where wildland fires might be difficult to locate. These systems are still in development, however, and false alarms are a concern.

Time, Expense, and Other Competing Concerns Limit the Use of Protective Measures for Structures, but Efforts to Increase Their Use Are Under Way

Many homeowners have not used protective measures—such as creating and maintaining defensible space—for four primary reasons:

- *Time or expense.* State and local fire officials estimate that the price of creating defensible space can range from negligible, in cases where homeowners perform the work themselves, to $2,000 or more. Moreover, defensible space needs to be maintained, resulting in additional effort or expense in the future. Further, while fire-resistant roofing materials are available that are comparable in cost to more flammable options and, for a home under construction may result in no additional expense, replacing a roof on an existing home can cost thousands of dollars.

- *Competing concerns*. Although modifying landscaping to create defensible space has proven to be a key element in protecting structures from wildland fire, officials and researchers have reported that some homeowners are more concerned about the effect landscaping has on the appearance and privacy of their property, as well as on habitat for wildlife.

- *Misconceptions about wildland fire behavior*. Fire officials and researchers told us that some homeowners do not recognize that a structure and its surroundings constitute fuel that contributes to the spread of wildland fire or understand exactly how a wildland fire ignites structures. Further, they may not know that they can take effective steps to reduce their risk.

- *Lack of awareness of homeowners' responsibility.* Fire officials told us that some homeowners in the wildland urban interface may expect the same level of service they received in more urban areas and do not understand that rural areas may have less firefighting personnel and equipment and longer response times. Also, when a wildland fire burns near communities, so many houses may be threatened simultaneously that firefighters may be unable to protect all of them.

Federal, state, and local agencies and other organizations are taking steps in three main areas to help increase the use of protective measures.[10] First, government agencies and other organizations are educating people about the effectiveness of simple steps they can take to reduce the risk to homes and communities. The primary national education effort is the Firewise Communities program,[11] which both educates homeowners about available protective measures and also promotes additional steps that state and local officials can take to educate homeowners. Education efforts help demonstrate that defensible space can be attractive, provide privacy, and improve wildlife habitat.

Second, some federal, state, and local agencies are directly assisting homeowners in creating defensible space by providing equipment or financial assistance to reduce fuels near structures. Under the National Fire Plan[12], for instance, federal firefighting agencies provide grants or otherwise assist in reducing fuels on private land. State and local governments have provided similar assistance.

Third, some state and local governments have adopted laws that require maintaining defensible space around structures or the use of fire-resistant building materials. For example, California requires the creation and maintenance of defensible space around homes and the use of fire-resistant roofing materials in certain at-risk areas. Officials of one county we visited attributed the relatively few houses damaged by the 2003

[10]In addition, some insurance companies also direct homeowners in high-risk areas to create defensible space. Historically, the insurance industry has not placed a high priority on wildland fire issues because of relatively low losses compared with other hazards, such as hurricanes or earthquakes.

[11]Firewise Communities is jointly sponsored by the International Association of Fire Chiefs, National Emergency Management Association, National Association of State Fire Marshals, National Association of State Foresters, National Fire Protection Association, Federal Emergency Management Agency, U.S. Fire Administration, Forest Service, Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and the National Park Service. Numerous state and local fire and forestry officials also participate in Firewise program activities.

[12]The National Fire Plan was developed by the Department of Agriculture and the Department of the Interior after severe wildland fires in 2000. In fiscal year 2001, Congress almost doubled funding for federal firefighting agencies to help meet the plan's objectives to (1) increase fire suppression preparedness; (2) rehabilitate and restore lands and communities damaged by wildland fire; (3) reduce hazardous fuels; and (4) assist communities through education, hazard mitigation, and training and equipment for rural and volunteer fire departments.

Southern California fires in the county, in part, to its adoption and enforcement of laws requiring defensible space and the use of fire-resistant building materials. Not all states or localities at risk of wildland fire, however, have required such steps. Some state and local officials told us that laws had not been adopted because homeowners and developers resisted them. Furthermore, to be effective, laws that have been adopted must be enforced, and this does not always happen.

Effective Adoption of Technologies to Achieve Communications Interoperability Requires Better Planning and Coordination

Technologies are available or under development to help improve communications interoperability so that personnel from different public safety agencies responding to an emergency, such as a wildland fire, can communicate effectively with one another. Short-term, or patchwork, interoperability solutions use technology to interconnect two or more disparate radio systems so that voice or data from one system can be made available to all systems. The principal advantage of this solution is that agencies can continue to use existing communications systems, an important consideration when funds to buy new equipment are limited. Patchwork solutions include the following:

- *Audio switches* that provide interoperability by connecting radio and other communications systems to a device that sends the audio signal from one agency's radio to all other connected radio systems. Audio switches can interconnect several different radio systems, regardless of the frequency bands or type of equipment used.

- *Crossband repeaters* that provide interoperability between systems operating on different radio frequency bands by changing frequencies between the two radio systems.

- *Console-to-console patches* that are not "on-the-scene" devices but instead connect consoles located at the dispatch centers where calls for assistance are received. The device links the dispatch consoles of two radio systems so that the radios connected to each system can communicate with one another.

Other interoperability solutions involve developing and adopting more sophisticated radio or communications systems that follow common standards or can be programmed to work on any frequency and to use any desired modulation type, such as AM or FM. These include:

- *Project 25 radios*, which must meet a set of standards for digital two-way radio systems that allow for interoperability between all

jurisdictions using these systems. These radios are beginning to be adopted by a variety of federal, state, and local agencies.

- *Software-defined radios* that will allow interoperability among agencies using different frequency bands, proprietary systems from different manufacturers, or different modulation types (such as AM or FM). Software-defined radios, however, are still being developed and are not yet available for use by public safety agencies.

- *Voice over Internet Protocol* that treats both voice and data as digital information and enables their movement over any existing Internet Protocol data network.[13] No standards exist for radio communications using Voice over Internet Protocol, and, as a result, manufacturers have produced proprietary systems that may not be interoperable.

Whether the solution is a short-term patchwork approach or a long-term communications upgrade, officials we spoke with explained that planning and coordination among agencies are critical for successfully determining which technology to adopt and for agreeing on funding sources, timing, training, maintenance, and other key operational and management issues. State and local governments play an important role in developing and implementing plans for interoperable communications because they own most of the physical infrastructure for public safety systems, such as radios, base stations, repeaters, and other equipment. In the past, public safety agencies have depended on their own stand-alone communications systems, without considering interoperability with other agencies. Yet as firefighting and other public safety agencies increasingly work together to respond to emergencies, including wildland fires, personnel from different agencies need to be able to communicate with one another. Reports by GAO,[14] the National Task Force on Interoperability, and others have identified lack of planning and coordination as key reasons hampering communications interoperability among responding agencies. According to these reports, federal, state, and local government agencies have not worked together to identify their communications needs and develop a coordinated plan to meet them. Without such planning and coordination, new investments in communications equipment or infrastructure may not improve the effectiveness of communications among agencies.

[13]In some cases, this is the Internet; and in others, it is a private data network.

[14]See GAO, *Homeland Security: Challenges in Achieving Interoperable Communications for First Responders*, GAO-04-231T (Washington, D.C.: Nov. 6, 2003).

In recent years, the federal government, as well as several states and local jurisdictions, have focused increased attention on improving planning and coordination to achieve communications interoperability. The Wireless Public Safety Interoperable Communications Program (SAFECOM), within the Department of Homeland Security's Office of Interoperability and Compatibility,[15] was established to address public safety communications issues within the federal government and to help state, local, and tribal public safety agencies improve their responses through more effective and efficient interoperable wireless communications. SAFECOM has undertaken a number of initiatives to enhance communications interoperability. For example, in a joint project with the commonwealth of Virginia, SAFECOM developed a methodology that could be used by states to assist them in developing a locally driven statewide strategic plan for enhancing communications interoperability. Several states have established statewide groups to address communications interoperability. For example, in Washington, the communications committee has developed a statewide public safety communication plan and an inventory of state government-operated public safety communications systems. Finally, some local jurisdictions are working together to identify and address communications interoperability issues.

Mr. Chairman, this concludes my prepared statement. I would be pleased to answer any questions that you or other Members of the Subcommittee may have at this time.

[15]The Wireless Public Safety Interoperable Communications Program, otherwise known as SAFECOM, was first established as an Office of Management and Budget e-initiative in 2001.

GAO Contacts and Staff Acknowledgments

For further information on this testimony, please contact me at (202) 512-3841 or nazzaror@gao.gov, or Keith Rhodes at (202) 512-6412 or rhodesk@gao.gov. Individuals making key contributions to this testimony included Jonathan Altshul, Naba Barkakati, David P. Bixler, William Carrigg, Ellen Chu, Jonathan Dent, Janet Frisch, Barry T. Hill, Richard Johnson, Chester Joy, Nicholas Larson, Steve Secrist, and Amy Webbink.

GAO's Mission

The Government Accountability Office, the audit, evaluation and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's Web site (www.gao.gov). Each weekday, GAO posts newly released reports, testimony, and correspondence on its Web site. To have GAO e-mail you a list of newly posted products every afternoon, go to www.gao.gov and select "Subscribe to Updates."

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. Government Accountability Office
441 G Street NW, Room LM
Washington, D.C. 20548

To order by Phone: Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm
E-mail: fraudnet@gao.gov
Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Gloria Jarmon, Managing Director, JarmonG@gao.gov (202) 512-4400
U.S. Government Accountability Office, 441 G Street NW, Room 7125
Washington, D.C. 20548

Public Affairs

Paul Anderson, Managing Director, AndersonP1@gao.gov (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, D.C. 20548