

S. HRG. 114-337

A REVIEW OF PAST WILDFIRE SEASONS TO INFORM AND IMPROVE FUTURE FEDERAL WILDLAND FIRE MANAGEMENT STRATEGIES

HEARING BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE ONE HUNDRED FOURTEENTH CONGRESS FIRST SESSION

NOVEMBER 17, 2015



Printed for the use of the
Committee on Energy and Natural Resources

Available via the World Wide Web: <http://fdsys.gov>

**A REVIEW OF PAST WILDFIRE SEASONS TO INFORM AND IMPROVE FUTURE
FEDERAL WILDLAND FIRE MANAGEMENT STRATEGIES**

**A REVIEW OF PAST WILDFIRE SEASONS TO
INFORM AND IMPROVE FUTURE FEDERAL
WILDLAND FIRE MANAGEMENT STRATEGIES**

HEARING
BEFORE THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED FOURTEENTH CONGRESS
FIRST SESSION

NOVEMBER 17, 2015



Printed for the use of the
Committee on Energy and Natural Resources

U.S. GOVERNMENT PUBLISHING OFFICE

98-946

WASHINGTON : 2016

For sale by the Superintendent of Documents, U.S. Government Publishing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENERGY AND NATURAL RESOURCES

LISA MURKOWSKI, Alaska, *Chairman*

JOHN BARRASSO, Wyoming	MARIA CANTWELL, Washington
JAMES E. RISCH, Idaho	RON WYDEN, Oregon
MIKE LEE, Utah	BERNARD SANDERS, Vermont
JEFF FLAKE, Arizona	DEBBIE STABENOW, Michigan
STEVE DAINES, Montana	AL FRANKEN, Minnesota
BILL CASSIDY, Louisiana	JOE MANCHIN III, West Virginia
CORY GARDNER, Colorado	MARTIN HEINRICH, New Mexico
ROB PORTMAN, Ohio	MAZIE HIRONO, Hawaii
JOHN HOEVEN, North Dakota	ANGUS S. KING, JR., Maine
LAMAR ALEXANDER, Tennessee	ELIZABETH WARREN, Massachusetts
SHELLEY MOORE CAPITO, West Virginia	

KAREN K. BILLUPS, *Staff Director*

PATRICK J. MCCORMICK III, *Chief Counsel*

LUCY MURFITT, *Senior Counsel and Natural Resources Policy Director*

ANGELA BECKER-DIPPMANN, *Democratic Staff Director*

SAM E. FOWLER, *Democratic Chief Counsel*

BRYAN PETIT, *Democratic Senior Professional Staff Member*

CONTENTS

OPENING STATEMENTS

	Page
Murkowski, Hon. Lisa, Chairman and a U.S. Senator from Alaska	1
Cantwell, Hon. Maria, Ranking Member and a U.S. Senator from Washington	3

WITNESSES

Fennell, Anne-Marie, Director, Natural Resources and Environment, U.S. Government Accountability Office	6
Maisch, John “Chris”, State Forester and Director, Division of Forestry, Alaska Department of Natural Resources	26
Covington, Dr. William Wallace, Regents’ Professor of Forest Ecology and Director, Ecological Restoration Institute, Northern Arizona University	43
Zerkel, Richard, President, Lynden Air Cargo, LLC	52
Burnett, Mike, Fire Chief, Chelan County Fire District 1	57
Wyss, Jon, Chairman, Okanogan County Long Term Recovery Group	64

ALPHABETICAL LISTING AND APPENDIX MATERIAL SUBMITTED

Burnett, Mike:	
Opening Statement	57
Written Statement	59
Responses to Questions for the Record	128
(The) California Forest and Watershed Alliance:	
Statement for the Record	278
Cantwell, Hon. Maria:	
Opening Statement	3
Chart 1–Wenatchee Complex in 2012	87
Chart 2–Behive Reservoir	89
Chart 3–Fire Treated Road	91
(The) Corps Network:	
Letter for the Record	283
Covington, Dr. William Wallace:	
Opening Statement	43
Written Testimony	45
Responses to Questions for the Record	119
Fennell, Anne-Marie:	
Opening Statement	6
Written Testimony	8
Responses to Questions for the Record	114
GAO–13–684 Wildland Fire Management: Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success dated August 2013	144
GAO–15–772 Wildland Fire Management: Agencies Have Made Several Key Changes but Could Benefit From More Information About Effectiveness dated September 2015	199
Maisch, John “Chris”:	
Opening Statement	26
Written Testimony	28
Murkowski, Hon. Lisa:	
Opening Statement	1
Wyss, Jon:	
Opening Statement	64
Written Testimony	67

IV

	Page
Wyss, Jon—Continued	
Responses to Questions for the Record	129
Zerkel, Richard:	
Opening Statement	52
Written Testimony	54

A REVIEW OF PAST WILDFIRE SEASONS TO INFORM AND IMPROVE FUTURE FEDERAL WILDLAND FIRE MANAGEMENT STRATE- GIES

TUESDAY, NOVEMBER 17, 2015

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Committee met, pursuant to notice, at 10:01 a.m. in Room SD-366, Dirksen Senate Office Building, Hon. Lisa Murkowski, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

The CHAIRMAN. I call to order the meeting of Energy and Natural Resources Committee.

Before we commence with the hearing, I think it is appropriate, and I know that on the floor of the Senate at this appointed hour, ten o'clock, a 1-minute moment of silence is being observed for those that were the victims of the horrible tragedy in Paris. So at this moment I would like to observe a 1-minute moment of silence. [Moment of silence.]

The CHAIRMAN. Thank you.

This is a pretty somber way to begin, and it is also a very somber subject this morning as we talk about the 2015 fire season. It was a tragic one. It was punctuated by some fatalities. We lost residents who could not escape the flames and the brave firefighters who gave their lives to keep our communities safe.

The Okanogan Complex fire in Washington claimed the lives of three heroes, Thomas Zbyszewski, Andrew Zajac and Richard Wheeler. I want to start by acknowledging them and offering prayers to their families.

Each year the wildfire season seems to include new worsts and historical records. For its part 2015 has been marked by a relentless wildfire season that has stretched nearly all year. According to the National Interagency Fire Center more than 9.4 million acres have burned through October 30. This year's season is among the most devastating years for wildfires since reliable records began in 1960, coming close to 2006 when an all time high of nearly 9.9 million acres burned.

Mega fires, which are the fires over 100,000 acres in size and incomprehensible just decades ago, are becoming the new norm. Five mega fires were burning at the same time in September alone.

The majority of our nation's fires continue to occur in my State of Alaska, and this year was no exception. We had over five million acres burned in Alaska. This is an area the size of the State of Connecticut. Only the 2004 fire season, where nearly 6.6 million acres burned, was worse for us.

This year the fire season in Alaska was also unique and not in a good way. We did not have much snow over the winter and the spring featured record warm temperatures creating some unusually dry conditions and then came the lightning. On one day alone, near the summer solstice, lightning struck our state around 15,000 times, so over 15,000 strikes in one day. Ultimately lightning caused more than half of the more than 700 fires in Alaska this season.

At one point this summer more than 200 fires were burning in the state, all over the state and all at once. Numerous Native Alaskan villages were evacuated because of fires that threatened air quality and structures. The thick smoke in Fairbanks pushed air quality to hazardous levels, forcing outdoor activities to be canceled. Dozens of homes north and south of Anchorage were lost. Anchorage spent 24 days at preparedness level five. You all on the panel here clearly know what level five is, but for those who are unfamiliar, it is the highest level. These wildfires drained budgets and required so much manpower to battle that officials enlisted the help of international crews at times.

Unfortunately there is no easy solution. We cannot simply match the increasing wildfire threat with greater and greater suppression force and call it a day. Wildfire suppression and its escalating costs are economically, ecologically, and socially unsustainable, and the 2015 fire season underscores that point.

We must recognize that many of the same factors that are increasing the size, frequency and intensity of wildfires are also driving up wildfire suppression costs both in actual dollars and as a portion of the Forest Service total budget. These factors include excessive fuel loads, due in part to decades of fire exclusion, a changing climate, insect and disease infestation, severe drought, the spread of invasive species and expanding wildland urban interface. But that is not all. Operational factors associated with wildfire management, our objectives, strategies and tactics, all have significant cost implications. This includes the aviation assets that we deploy today.

We spent \$2.1 billion fighting fires this season and \$4.2 billion in total on wildfire management. It is not even clear where these dollars were spent and whether they were well spent. That is due, in part, to the fact that the agencies do not bother to conduct reviews of the large, expensive fires.

The Forest Service has claimed that the wildfire problem is a budget problem, but that is probably an oversimplification. We all agree that Congress must end the practice of fire borrowing, but we just cannot throw money at the problem.

In the Interior Appropriations bill that I chair the Subcommittee on, we provide a fiscally responsible approach to end fire borrowing. It would budget for 100 percent of the 10-year average for fire suppression and provide a limited emergency reserve, or contingency fund, for fire fighting in the above average years. I think

that is part of the solution, but the wildfire problem is not just a budgeting problem. It is also a management problem, and we have failed to appropriately manage our fire dependent forests and fire prone landscapes and that has predisposed our forests to mega fires.

We must work with our state agencies, our local communities and the public to increase community preparedness and make our forests healthy again. Healthy, resilient forests are fire resistant forests. Yet, despite knowing the value of fuel reduction treatments in mitigating wildfire risks, increasing fire fighter safety and restoring the health of our forests, active management is still often met with a series of discouraging and near insurmountable obstacles. High upfront costs, long planning horizons and regulatory environment requirements, including what seem like unending environmental reviews, are impeding our ability to implement treatments at the pace and the scale these wildfires are occurring.

These are big problems that will take cooperation and commitment to solve. Senator Cantwell and I have agreed to work together and with members of this Committee to develop a better wildfire management strategy for our country. I think it is fair to say that Senator Cantwell and I share the view that this is strategy that should be guided by some principles.

The principles include responsibly funding wildfire suppression, ending the unsustainable practice of fire borrowing, improving operational efficiencies to ensure the availability and effectiveness of the aviation fleet and fire fighter safety, increasing community preparedness through Fire Wise activities and implementing community wildfire protection plans, making the necessary investments in a full array of fuel treatments to include not just prescribed fire but also mechanical thinning, increasing the use of technology on wildfires and reducing paperwork to get needed projects implemented in a timely manner.

We know this type of strategy is necessary because we have just endured another terrible fire season that has affected many of our home states, many of the people that we know and many of the lands and the landscapes that we treasure.

So this is not just any Tuesday morning here at the Energy Committee. This cannot be a review without a purpose where we turn the page, close the book and consider our responsibility is met for another year. We have a lot of work to do, and we need to work together to develop real solutions to the wildfire problem.

With that, I turn to Senator Cantwell.

**STATEMENT OF HON. MARIA CANTWELL,
U.S. SENATOR FROM WASHINGTON**

Senator CANTWELL. Well thank you, Madam Chairman, and thank you for holding this important hearing. Thank you for the witnesses coming today. We look forward to hearing from all of you.

I also want to thank the Chair for allowing us to do a field hearing last August in Seattle, Washington that our colleague, Senator Barrasso, came out for. We certainly appreciate both the field hearing and him joining us for that.

We learned many things from the hearings that we have had so far, and we are going to learn more today. We have learned there are actions that agencies can take and that communities can take to decrease the risk of forest fires. We learned about the benefits of creating surge capacity to respond in these cases when we do have extreme events. But what has stood out most for me, from one of the witnesses that we had in Seattle, Dr. Medler from Western Washington University, was that he explained we have not seen the worst yet. This is something that requires immediate action.

I want to thank Jon Wyss and Chief Burnett for being here today from the State of Washington. These are two people who are intimately familiar with these issues surrounding wildfires, particularly given our experience over the past two summers.

In 2014 our state experienced the Carlton Complex, the worst fire in our state history. So earlier this year when the Committee began work on fire and discussing what we learned from that tragedy, we were scheduling listening sessions all across the State of Washington about what the Federal Government could do better and what we could do to help local communities. What we did not realize at the time that we had scheduled those meetings is that 2015 was going to be an even more dramatic fire season.

Almost one million acres in my state burned in about a month. That is an area the size of Delaware. So in addition to severe economic loss to the timber industry, the recreational economy, tribes, and the fire fighters in Washington State, who suffered a tragic loss, these impacts are unbelievable.

I want to say that the three Forest Service fire fighters that were killed in the line of duty while protecting the communities in which they live were the best among us, Andrew Zajac, Richard Wheeler and Tom Zbyszewski. A fourth fire fighter, Daniel Lyon, was severely burned in the entrapment and has been going through recovery. Clearly 2015 was a tragedy.

As I have traveled across the state looking at various issues I heard compelling stories from fire fighters, business owners and residents who lost their homes or had to evacuate that what we needed to do was to do better. Fire fighters, county commissioners, Forest Service people, legislators, all came forward with issues about coordination, response, making sure that fewer homes burned, making sure our fire fighters are safer, and proactively decreasing the intensity of these fires so that they can be better managed. I know that the colleagues that are present here today have experienced similar fire seasons in their states, as Chairman Murkowski just mentioned.

Unfortunately, there are only so many spots available on the witness table, or I am sure that every one of us could have filled the whole table with people from our state who are stakeholders in this discussion. So before we begin I would just like to recognize a couple people who are not at the table.

From Aero-Flite, Mike, if he is here he can wave his hand, a company that is in Spokane, Washington. The air tanker fleet is very important to how we fight fires and continuing to improve that service with the Forest Service giving contracts, I think is very important.

I want to recognize Brian Gunn from the Colville Tribe, who is also here. This summer wildfires spread into the reservation and destroyed 20 percent of their timber. A quarter of the tribe's economy is generated from timber, so to say that this was a big deal is an understatement. They lost upwards of \$1 billion of standing timber.

This hearing is the third in our Committee that we have had so far since the wildfires of 2015. I am pretty sure that makes a record for the Committee. I think it shows that we are serious about getting something done, and I want to thank Senator Murkowski for outlining some of the things that she and I believe that should be in a bill. Ending the practice of fire borrowing so that we actually do more in prevention and preparedness up front, improving the efficiencies of our operation, ensuring that the fire fighters have the best equipment and those in communities that are challenged by how broad the map has become have every resource available to them, increasing community preparedness through activities such as Fire Wise and risk mapping, and investing in fuel treatments that we know will make a difference such as prescribed burn or mechanical thinning.

Dr. Covington, I cannot wait to hear from you today about this issue particularly because I am very interested and will show some maps about thinning success in Washington State and where it mattered in prevention. But also just this overlay as it relates to where our fires are with ponderosa pine. I really want to understand how we are going to protect our forests.

Increasing our use of technology and including unmanned aerial vehicles to give us more information, and for us in the central part of the state, it is clear we need a new Doppler system to talk about high wind incidents which we certainly experienced the day that our fire fighters lost their lives.

All these are very, very important issues, and I am pleased to be working with the Chair on this. We have also had many conversations with our colleague, Cathy McMorris-Rodgers in the House of Representatives, since her legislative district has been front and center in all of this.

I also want to just say that I know that while we have put out a white paper that we discussed in Seattle at our hearing, that there are many inputs that we have received along with what we are going to hear today.

I hope, Madam Chairman, that all of us on this Committee of Western States can work together, because I think we see that those who are represented here today understand that we do not want to face the 2016 fire season without better tools, without better processes, without better operations to help our communities and help our states.

Thank you very much.

The CHAIRMAN. Well said. Thank you, Senator Cantwell.

With that we will go to the panel before us. Again we appreciate you coming to the Committee this morning and giving us your perspective.

The Committee will be led off this morning by Anne-Marie Fennell, who is the Director for the Natural Resources and Envi-

ronment Team at the U.S. Government Accountability Office. We appreciate you being here.

Next we have Mr. Chris Maisch. Chris is the State Forester and Director for the Division of Forestry with the State of Alaska, very skilled and very much an expert in so many of these issues. So we appreciate you traveling to be with us this morning.

Next we have Dr. William Wallace Covington, who is the Regents' Professor of Forest Ecology, the Executive Director for the Ecological Restoration Institute at Northern Arizona University. Thank you for being before the Committee this morning.

Next we have another Alaskan, who will speak to us from the air tankers perspective and how we deal with these suppression efforts from the air, Mr. Richard Zerkel, who is President of Lynden Air Cargo. Thank you for being here this morning.

We also have Mr. Mike Burnett, who is the Fire Chief from the Chelan County Fire.

Rounding out the panel we have Mr. Jon Wyss, who is the Chairman of the Okanogan and Carlton Complex Long Term Recovery.

We have a lot of expertise here this morning before the Committee, and we thank you for being with us.

Ms. Fennell, if you would like to lead off? Please keep your oral testimony to five minutes and your full testimony will be incorporated as part of the record.

STATEMENT OF ANNE-MARIE FENNELL, DIRECTOR, NATURAL RESOURCES AND ENVIRONMENT, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Ms. FENNELL. Chairman Murkowski, Ranking Member Cantwell and members of the Committee, I'm pleased to be here today to discuss our recent work on wildland fires.

Wildland fires play an important ecological role but cost billions each year and result in damage and loss of life. As you know the 2015 fire season has been especially severe with over nine million acres burned.

The Forest Service and Interior are responsible for wildland fire management on Federal lands including contracting for aircraft to help suppress fires. Increased fire intensity has prompted agency efforts to try to better manage fires. Understanding the effectiveness of these efforts takes on a heightened importance since these agencies have obligated \$8.3 million over 6 years to suppress fires.

My statement today focuses on one, how the Forest Service and Interior assess the effectiveness of their wildland fire management programs, and two, the Forest Service efforts to modernize the large air tanker fleet and challenges in doing so. My testimony is based on reports we issued in September 2015 and August 2013.

First, Forest Service and Interior assess the effectiveness of their wildland programs in several ways including through performance measures, efforts to assess particular activities and reviews of fires. In our September report we found that the Forest Service and Interior acknowledged their performance measures needed improvement and were developing new ones. In addition the agencies are undertaking efforts to assess activities to reduce hazardous vegetation that can fuel fires.

However, the Forest Service and Interior have not consistently followed agency policy in selecting and reviewing the fires to determine agency effectiveness in responding to fires. Their policies generally direct them to review each fire involving Federal expenditures of \$10 million or more. Agency officials told us that these policies over emphasize cost rather than effectiveness in responding to fires.

The agencies, though, have not developed specific criteria for selecting fires. For example, Forest Service officials told us that they judgmentally select fires based on such broad criteria as national significance. Accordingly, the Forest Service reviewed five fires that occurred in 2012 and ten that occurred in 2013. But given its broad criteria it's not clear why the Forest Service selected these fires and not others such as the 2013 Rim Fire which burned more than 250,000 acres and was the costliest fire to suppress that year.

We concluded that by developing criteria for selecting and reviewing fires the agencies may obtain useful information about effectively responding to fires. As a result we recommended in our September report that the Forest Service and Interior develop specific criteria for selecting and reviewing fires and update their policies accordingly. The agencies generally agreed.

Second, in our 2013 report we found that the Forest Service faced challenges in modernizing its fleet of large air tankers which declined from 44 in 2002 to eight in 2013. Specifically we found that the Forest planned to modernize its fleet by obtaining aircraft from various sources over the near, medium and long term but each component of this approach faced challenges. Some of these challenges persist while others are less relevant today.

For example, the Forest Service had awarded contracts for seven next generation large air tankers but as of 2013 only one had completed necessary Federal approval and certification processes. Agency officials told us that they now have 20 privately-owned, large air tankers under contract and another seven air tankers transferring from the Coast Guard.

In conclusion, the increasing severity and cost of wildland fires highlights the importance of Federal agencies continuously and systematically assessing the effectiveness of their approaches so as to identify possible improvements in combating wildland fires in an ever changing landscape.

Chairman Murkowski, Ranking Member Cantwell and members of the Committee, this concludes my prepared statement. I'm happy to respond to questions.

[The prepared statement of Ms. Fennell follows:]



United States Government Accountability Office

Testimony
Before the Committee on Energy and
Natural Resources, U.S. Senate

For Release on Delivery
Expected at 10:00 a.m. ET
Tuesday, November 17, 2015

WILDLAND FIRE MANAGEMENT

Agencies' Efforts to Assess Program Effectiveness and Modernize the Firefighting Aviation Fleet

Statement of Anne-Marie Fennell, Director
Natural Resources and Environment

GAO Highlights

Highlights of GAO's 2017 testimony before the Committee on Energy and Natural Resources, U.S. Senate

Why GAO Did This Study

Wildland fires play an important ecological role on the landscape, but they cost billions each year, result in loss of life, and cause damage to homes and other structures. The Forest Service and Interior are responsible for wildland fire management on federal lands, including acquiring firefighting assets such as large airtankers to assist in fire suppression activities. Increased fire intensity has prompted efforts aimed at implementing more effective fire management strategies. Understanding the effectiveness of these efforts takes on heightened importance given that the Forest Service and Interior have obligated \$8.3 billion to suppress wildland fires in fiscal years 2008 through 2014.

This testimony is based on GAO reports issued in September 2015 and August 2013. It focuses on (1) how the federal wildland fire agencies assess the effectiveness of their wildland fire management programs and (2) Forest Service efforts to modernize the large airtanker fleet and challenges it faces in doing so. For the 2015 report, GAO reviewed agency performance measures and other ways the agencies assess effectiveness. For the 2013 report, GAO reviewed large airtanker planning and acquisition documents. GAO also conducted extended updates by reviewing documentation and interviewing officials.

What GAO Recommends

GAO recommended in September 2015 that the agencies develop specific criteria for reviewing wildland fires. The agencies generally agreed. GAO is not making any new recommendations in this testimony.

See GAO-16-217. For more information, contact Kristine Harris, Director, at (202) 512-3941 or kristineh@gaopress.com.

November 17, 2015

WILDLAND FIRE MANAGEMENT**Agencies' Efforts to Assess Program Effectiveness and Modernize the Firefighting Aviation Fleet****What GAO Found**

As GAO found in its September 2015 report, the Department of Agriculture's Forest Service and the Department of the Interior assess the effectiveness of their wildland fire management programs in several ways, including through performance measures, evaluations of particular activities, and reviews of specific wildland fires. Forest Service and Interior officials told GAO their performance measures need to be improved and that they are working to do so. For example, in fiscal year 2014, the Forest Service began developing a performance measure intended to reflect that, in some cases, allowing naturally-ignited fires to burn can provide natural resource benefits at a lower cost and lower risk to personnel than fully suppressing the fire as quickly as possible. Officials told GAO they plan to finalize the measure and use it in 2017. In addition, Forest Service and Interior have undertaken efforts to evaluate particular wildland fire management activities, such as efforts to reduce potentially hazardous vegetation that can fuel fires, known as fuel reduction, and assess the performance of firefighting aircraft. However, GAO's 2015 report found that the Forest Service and Interior conducted reviews to assess their effectiveness in responding to wildland fire, but did not consistently follow agency policy which generally directs them to review each fire involving federal expenditures of \$10 million or more. Forest Service and Interior officials told GAO that this policy overly emphasized the cost of wildland fire suppression rather than the effectiveness of their response to fires. However, the Forest Service and Interior have not established specific criteria for selecting fires for review and conducting the reviews. For example Forest Service officials told GAO the agency judgmentally selects incidents to review based on broad criteria such as complexity and national significance. By developing specific criteria, GAO concluded that the agencies may enhance their ability to help ensure that their fire reviews provide useful information about the effectiveness of their wildland fire activities.

In its August 2013 report, GAO found that the Forest Service faced challenges in modernizing the government's fleet of large airtankers—which had declined from 44 in 2002 to 8 in 2013—but since that report the agency has increased the availability of such aircraft. GAO found in 2013 that the Forest Service, which is responsible for contracting for large airtankers, planned to modernize the fleet by obtaining large airtankers from various sources over the near, medium, and long term, but that each component of that approach faced challenges, making the continued availability of such aircraft to meet fire suppression needs uncertain. For example, for the medium term, the Forest Service had awarded contracts for seven "next-generation" large airtankers, but as of August 2013 only one had completed necessary federal approval and certification processes. Since that report, Forest Service officials told GAO that the agency has increased the availability of large airtankers. Specifically, as of November 2015, the agency had contracted for 20 privately-owned large airtankers, and another 7 large airtankers are to be transferred to Forest Service ownership from the Coast Guard.

Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee:

I am pleased to be here today to discuss our recent work on federal wildland fire management. As you know, wildland fires have resulted in tragic loss of life and damage to homes, infrastructure, and important cultural and natural resources. The 2015 fire season has been especially severe, with over 9 million acres burned to date—well over the annual average of about 6.5 million acres burned during each of the last 10 years. However, wildland fire also plays an important ecological role in maintaining healthy ecosystems, with many ecosystems being adapted to or dependent upon fire. Balancing the need to suppress unwanted wildland fires to protect people and resources with the need to recognize fire's natural role on the landscape is a complex task, particularly given the current condition of the nation's landscape, increased development in and around wildlands (an area often called the wildland-urban interface), and the future outlook for wildland fires. For example, changing climate conditions, including drier conditions in certain parts of the country, have increased the length and severity of wildfire seasons, according to many scientists and researchers; in the western United States, the average number of days in the fire season has increased from approximately 200 in 1980 to approximately 300 in 2013.¹

Five federal land management agencies—the Forest Service within the Department of Agriculture and the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service within the Department of the Interior—are responsible for managing wildland fires on federal lands. The agencies' wildland fire management program has three primary components: preparedness, suppression, and fuel reduction.² To prepare for a wildland fire season, the agencies acquire firefighting assets—including firefighters, fire engines, aircraft,

¹Booz Allen Hamilton, *2014 Quadrennial Fire Review* (Washington, D.C.: May 2015). The states included in this statistic were Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. See also National Research Council, *Climate Change: Evidence, Impacts, and Choices. Answers to Common Questions about the Science of Climate Change* (Washington, D.C.: 2012) and U.S. Climate Change Science Program, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* (Washington, D.C.: May 2008).

²Other fire program components include prevention; science, research, and development; site rehabilitation; and assistance to nonfederal entities.

and other equipment—and station them at individual federal land management units or at centralized dispatch locations in advance of expected wildland fire activity. When a fire starts, interagency policy calls for the agencies to consider land management objectives and the structures and resources at risk when determining whether or how to suppress it. A wide spectrum of strategies is available to choose from, and the land manager at the affected local unit is responsible for determining which strategy to use—from conducting all-out suppression efforts to monitoring fires within predetermined areas in order to provide natural resource benefits. Fuel reduction refers to agencies' efforts to reduce potentially hazardous vegetation that can fuel fires, in an effort to reduce the potential for severe wildland fires, lessen the damage they cause, limit the spread of flammable invasive species, and restore and maintain healthy ecosystems. The agencies use multiple approaches for reducing this vegetation, including setting fires under controlled conditions (prescribed burns), mechanical thinning, herbicides, certain grazing methods, or combinations of these and other approaches.

As part of their wildland fire management efforts, the agencies rely on firefighting aircraft—including fixed-wing airtankers, helicopters, and other aircraft—to assist in wildland fire suppression activities. Aircraft are used to conduct surveillance, deliver supplies, and drop retardant or water to extinguish or slow the growth of fires. In using aircraft, the agencies largely rely on private vendors that own and operate the aircraft under contract to the government. Among firefighting aircraft, large airtankers—those able to carry at least 1,800 gallons of fire retardant—are key resources for the agencies because of their ability to fly to remote areas and quickly assist in containing small fires before they become larger, costlier, and more dangerous. The Forest Service is responsible for contracting for large airtankers, although they may be used by any of the agencies. However, the number of large airtankers available under federal contract decreased substantially from 2002, when 44 large airtankers were available, to 2013, when 8 were available. The decrease in large airtankers was, in part, the result of aircraft being retired due to their age—in 2013, the average large airtanker was more than 50 years old—as well as agencies' concerns about the airtankers' safety and capability to perform the demanding fire aviation mission.

In recent decades, increased wildland fire intensity has prompted new policies and efforts aimed at implementing more effective management strategies to manage wildland fire. For example, in response to significant fire events, the agencies developed the Federal Wildland Fire Management Policy of 1995, under which the agencies continued to

move away from their earlier emphasis on suppressing every wildland fire, seeking instead, among other things, to respond to fires in ways that protect communities and important resources while considering both the cost and long-term effects of the response. The most recent guidance for the implementation of this policy was issued in 2009. As we found in our September 2015 report,³ this guidance provided managers with more flexibility in responding to wildland fires by allowing them to consider different options for response. According to agency documents, the guidance was intended to reduce barriers to risk-informed decision making, allowing the response to be more commensurate with the risk posed by the fire, the resources to be protected, and the agencies' land management objectives. The issuance of the 2009 guidance was one of several key changes the agencies had made in their approach to wildland fire management, in part to reflect this risk-based approach. Also, in that report we found that the agencies were working to distribute their fire management resources in ways that better reflect current conditions rather than continuing to rely primarily on historical funding amounts. These efforts take on greater importance in light of constrained budgets and the amount spent by federal agencies on wildland fire management. For example, the Forest Service and Interior obligated \$8.3 billion to suppress wildland fires in fiscal years 2009 through 2014. In addition, according to a 2015 report by Forest Service researchers, the amount the Forest Service spends on wildland fire management has increased from 17 percent of the agency's total funds in 1995 to 51 percent of funds in 2014⁴—highlighting the importance of the agencies understanding the effectiveness of their wildland fire management programs.

My statement today focuses on (1) how the federal wildland fire management agencies assess the effectiveness of their wildland fire management programs and (2) the Forest Service's efforts to modernize the large airtanker fleet and challenges it has faced in doing so. This testimony is based primarily on reports we issued in September 2015 and

³GAO, *Wildland Fire Management: Agencies Have Made Several Key Changes but Could Benefit from More Information about Effectiveness*, GAO-15-772 (Washington, D.C.: Sept. 16, 2015).

⁴David E. Calkin, Matthew P. Thompson, and Mark A. Finney, "Negative Consequences of Positive Feedbacks in U.S. Wildfire Management," *Forest Ecosystems*, vol. 2, no. 9 (2015).

August 2013.⁵ To examine how federal wildland fire management agencies assess program effectiveness, we reviewed documents, such as agency strategic plans, budget justifications, agency studies and strategy documents related to fire aviation, and reports resulting from fire reviews conducted by the agencies since 2009. We interviewed agency officials to identify key performance measures and other mechanisms the agencies use to determine the effectiveness of their wildland fire management programs and to understand agency efforts to identify their firefighting aircraft needs, including their use of information on performance and effectiveness. We also reviewed legislative and agency direction related to fire reviews and compared agency practices for conducting fire reviews with direction contained in relevant agency policy. To examine the Forest Service's efforts to modernize the large airtanker fleet, we reviewed agency documents related to large airtanker acquisition, management, and operations, as well as planning and acquisition documents. We also interviewed members of the fire aviation stakeholder community, including state officials, vendors that own and operate large airtankers, and national trade organizations. More details on the scope and methodology for this work can be found in each of our issued reports. In addition, this testimony includes selected updates we conducted in November 2015 on actions the agencies have taken since our 2013 report. To conduct the updates, we reviewed agency documentation, including documents related to firefighting aircraft, and interviewed Forest Service and Interior officials.

We conducted the work on which this testimony is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

⁵GAO-15-772 and GAO, *Wildland Fire Management: Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success*, GAO-13-684 (Washington, D.C.: Aug. 20, 2013).

Agencies Assess the Effectiveness of Their Programs in Several Ways but Have Not Consistently Conducted Reviews That Could Improve Responses to Fires

In our September 2015 report, we found that the agencies assess the effectiveness of their wildland fire management programs in several ways, including through performance measures, efforts to assess specific activities, and reviews of specific wildland fire incidents. We found that both the Forest Service and Interior were developing new performance measures, in part to help better assess the results of their current emphasis on risk-based management, according to agency officials.⁶ In addition, the agencies have undertaken multiple efforts to assess the effectiveness of activities such as fuel reduction treatments and aerial firefighting. We also found that the agencies had conducted reviews of their responses to wildland fires, but that they did not consistently follow agency policy in doing so or use specific criteria for selecting the fires they reviewed, limiting their ability to help ensure that their fire reviews provided useful information and meaningful results.

Agencies Use Various Performance Measures to Assess Wildland Fire Management

As we found in our September 2015 report, both the Forest Service and Interior use various performance measures, such as the number of acres treated to reduce fuels and the percentage of wildland fires contained during initial attack,⁷ to assess their wildland fire management effectiveness. These measures are reported in, among other things, the agencies' annual congressional budget justifications. Officials from both the Forest Service and Interior, however, told us their performance measures need improvement to more appropriately reflect their emphasis on a risk-based approach to wildland fire management and, in June 2015, officials from both agencies told us that they were working to improve them. For example, in fiscal year 2014, the Forest Service began developing a performance measure intended to reflect that, in some cases, allowing naturally-ignited fires to burn can provide natural resource benefits at a lower cost and lower risk to personnel than fully suppressing the fire as quickly as possible.⁸ Forest Service officials told us they are working with field units to evaluate whether this measure will effectively assess their efforts to implement a risk-based approach to fire management, and said they will adjust it as needed. The officials told us

⁶GAO-15-772.

⁷"Initial attack" refers to the initial efforts to suppress a wildland fire, generally encompassing the first 24 hours after a fire is reported.

⁸The performance measure is "Percent of acres burned by natural ignition with resource benefits."

they plan to finalize the measure and use it in 2017. Similarly, in fiscal year 2014 Interior began using a new performance measure intended to better reflect the variety of strategies, in addition to all-out suppression efforts, available to respond to wildland fires.⁹

Agencies Have Undertaken Multiple Efforts to Assess Effectiveness of Specific Activities

The agencies have also undertaken multiple efforts to assess the effectiveness of particular wildland fire management activities, such as fuel reduction and aerial firefighting. Regarding fuel reduction activities, in prior work we found that demonstrating the effectiveness of fuel reduction treatments is inherently complex and that the agencies did not have sufficient information to evaluate fuel treatment effectiveness, such as the extent to which treatments changed fire behavior.¹⁰ Without such information, we concluded that the agencies could not ensure that fuel reduction funds were directed to the areas where they can best minimize risk to communities and natural and cultural resources. Accordingly, we recommended in 2007 that the agencies take actions to develop additional information on fuel treatment effectiveness. The agencies agreed with this recommendation and have taken steps to address it. In our September 2015 report, we found that the agencies are continuing efforts to improve their understanding of fuel treatment effectiveness. For example, the Forest Service and Interior agencies use a system called Fuel Treatment Effectiveness Monitoring to assess fuel reduction treatment effectiveness.¹¹ The Forest Service began requiring such assessments in 2011, and Interior requested such assessments be

⁹The performance measure is "Percent of wildfires on [Department of the Interior]-managed landscapes where the initial strategy (ies) fully succeeded during the initial response phase."

¹⁰GAO, *Wildland Fire Management: Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuel Reduction Funds and Selecting Projects*, GAO-07-1166 (Washington, D.C.: Sept. 28, 2007) and GAO, *Wildland Fire Management: Federal Agencies Have Taken Important Steps Forward, but Additional, Strategic Action Is Needed to Capitalize on Those Steps*, GAO-09-577 (Washington, D.C.: Sept. 9, 2009).

¹¹Fuel Treatment Effectiveness Monitoring is a program to evaluate the effectiveness of prescribed fire and mechanical treatments designed to reduce the risk of wildfire. Forest Service and Interior agencies conduct assessments in instances where a wildfire either starts within or burns into an area that has been treated, to evaluate the resulting impacts on fire behavior and fire suppression actions. We have not assessed the agencies' implementation of this effort.

completed starting in 2012.¹² Under this approach, the agencies are to complete a monitoring report whenever a wildfire interacts with an area where a fuel reduction treatment was previously conducted.

Regarding aerial firefighting, in our August 2013 report, we found that Forest Service and Interior had not collected information on the performance and effectiveness of firefighting aircraft as part of their efforts to identify their firefighting aircraft needs.¹³ Specifically, we found that the agencies had not established data collection mechanisms to track the specific tactical uses of firefighting aircraft—for example, where retardant or water is dropped in relation to a fire as well as the objective of a drop, such as protecting a structure—or measure their performance and effectiveness in those uses. Since the 1960s, multiple reviews of federal fire aviation programs have called for the Forest Service and Interior to collect information on the performance of firefighting aircraft. At the time of our 2013 report, the Forest Service had recently begun an effort known as the Aerial Firefighting Use and Effectiveness Study to address this concern. We noted, however, that this study focused on large airtankers (which, as noted, are managed by the Forest Service) and that Interior did not have plans to collect performance information on the types of firefighting aircraft it manages. Accordingly, in that report we recommended that the agencies expand efforts to collect information on aircraft performance and effectiveness to include all types of firefighting aircraft in the federal fleet. The agencies generally agreed with our recommendation.

In our September 2015 report, we found that the Forest Service and Interior were jointly implementing the Aerial Firefighting Use and Effectiveness Study begun in 2012. According to the study website and agency officials, the agencies are collecting information on how aerial retardant and suppressant delivery affects fire behavior, and they plan to use this and other collected information to track the performance of

¹²The Interior agencies each issued their own guidance related to Fuel Treatment Effectiveness Monitoring. The National Park Service issued guidance in 2012, Bureau of Indian Affairs in 2013, Bureau of Land Management in 2014, and Fish and Wildlife Service in 2015.

¹³GAO-13-684.

specific aircraft types.¹⁴ As of November 2015, according to agency officials, the agencies had collected data on aircraft use in more than 100 fires as part of the study. In addition, according to these officials, as part of the study the agencies are developing specific ways to assess firefighting aircraft performance effectiveness to be used during the 2016 fire season. Agency officials told us the study is not a one-time activity but is an ongoing effort to continually provide information to help improve their use of firefighting resources.¹⁵

The Forest Service and Interior Agencies Have Not Consistently Conducted Reviews of Wildland Fire Incidents to Assess their Effectiveness

As detailed in our September 2015 report, the Forest Service and the Interior agencies have conducted reviews to assess their effectiveness in responding to wildland fires, but have not consistently followed agency policy in doing so and did not always use specific criteria for selecting the fires they reviewed. Congressional committee reports and agency policy have generally called for the agencies to review their responses to wildland fires involving federal expenditures of \$10 million or more, in part to help understand how to better contain suppression costs.¹⁶ The agencies, in turn, have each developed their own policies that generally direct them to review each fire that exceeds the \$10 million threshold and, in some cases, those policies note that fire reviews may be conducted for other purposes, such as where the fire raised significant political, social, natural resource, or policy concerns.

The agencies have not consistently conducted reviews of fire incidents meeting the \$10 million threshold, in part because, according to officials, doing so does not reflect the agencies' focus on assessing the effectiveness of their response to fire. However, the agencies have not developed specific criteria for selecting fire incidents for review. Forest Service officials told us that rather than selecting all fires with federal

¹⁴<http://www.fs.fed.us/fire/aviation/afue/index.html>, accessed July 31, 2015. Aircraft types involved in the study include fixed-wing airtankers, certain types of helicopters, and other aircraft.

¹⁵As of November 2015, we had not obtained documentation to determine the extent to which the agencies' actions are responsive to our 2013 recommendation.

¹⁶In fiscal years 2003 through 2010, congressional committee reports directed the Forest Service and Interior to conduct reviews of large fire incidents generally for the purpose of understanding how to better contain suppression costs; beginning in fiscal year 2006, these reports included a cost threshold, specifying that such reviews be conducted for fires involving federal expenditures of \$10 million or more.

expenditures of \$10 million or more to review, they changed their selection approach. These officials told us that focusing exclusively on suppression costs when selecting fires may keep the agency from choosing those fires where it can obtain important information and best assess management actions and ensure they are appropriate, risk-based, and effective. Instead, Forest Service officials told us the agency judgmentally selects incidents to review based on a range of broad criteria, such as complexity and national significance, taking into account political, social, natural resource, or policy concerns. Using these broad selection criteria, the Forest Service reviewed 5 wildland fires that occurred in 2012 and 10 that occurred in 2013. However, with these broad criteria it is not clear why the Forest Service selected those particular fires and not others. For example, the 2013 Rim Fire, which burned more than 250,000 acres and cost more than \$100 million to suppress—by far the costliest fire to suppress that year—was not among the 2013 fires selected for review.¹⁷ Moreover, the reviews completed for each of those years did not use consistent or specific criteria for conducting the reviews. As of July 2015, the agency had not selected fires to review from the 2014 wildland fire season and, when asked, agency officials did not indicate a time frame for doing so.

Forest Service officials told us they believe it is appropriate to judgmentally select fires to provide them flexibility in identifying which fires to review and which elements of the fire response to analyze. Nevertheless, Forest Service officials also acknowledged the need to develop more specific criteria for selecting fires to review and conducting the reviews. In July 2015, officials told us they were working to update their criteria for doing so. They provided us a draft update of the Forest Service policy manual, but this draft did not contain specific criteria for selecting fires for review or conducting the reviews. Moreover, officials did not provide a time frame for completing their update.

Within Interior, Bureau of Land Management officials told us that the agency completed its last fire review based on significant cost (i.e., federal expenditures of \$10 million or more) in 2013. These officials told us that the Bureau of Land Management, similar to the Forest Service, plans to shift the emphasis of its fire reviews to evaluate management

¹⁷The Rim Fire burned about 154,000 acres of Forest Service land, about 79,000 acres of National Park Service land, and about 23,000 acres of private land.

actions rather than focusing on cost, and that officials are working to determine criteria for selecting fires for review. Interior headquarters officials told us that the Fish and Wildlife Service and National Park Service have continued to follow the direction provided through their policies regarding reviews of fires that met the \$10 million threshold. Interior headquarters officials, however, acknowledged the need to improve Interior's approach to selecting fires for review to focus more on information about decision making rather than fire costs. In July 2015, the officials told us they planned to develop criteria other than cost for use by all Interior agencies in selecting fires to review, and that they planned to develop standard criteria for implementing the reviews, but they did not provide information about how they planned to develop such criteria or the factors they would consider.

Agency reports have likewise cited the need to improve both the processes for selecting fires for review and the implementation of the reviews. A 2010 report, for example, noted the importance of improving the selection of fires to review and stated that the agencies would benefit from a more productive review strategy.¹⁸ The report said the agencies' existing approach to conducting reviews tended to produce isolated efforts and unrelated recommendations rather than establishing a consistent foundation for continuous improvement. A 2013 report assessing the usefulness of the Forest Service's five reviews of 2012 fires noted shortcomings in consistency across the reviews, including unclear criteria for selecting fires and conducting reviews, as well as limitations in the specificity of the resulting reports and recommendations.¹⁹ Our previous body of work on performance management has shown that it is important for agencies to collect performance information to inform key management decisions, such as how to identify problems and take corrective actions and how to identify and share effective approaches.²⁰ We concluded that, by developing specific criteria for selecting fires for

¹⁸U.S. Department of Agriculture Independent Large Fire Cost Review Panel and Guidance Group, Inc., *Large Fire Cost Review for 2009* (August 2010).

¹⁹Wildland Fire Lessons Learned Center, *Lessons From Recent Large Fire Reviews: Briefing Paper* (August 7, 2013). There was no similar analysis performed of the Forest Service's 10 reviews of fires occurring in 2013.

²⁰See GAO, *Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making*, GAO-05-927 (Washington, D.C.: Sept. 9, 2005); GAO, *Nanotechnology: Improved Performance Information Needed for Environmental, Health, and Safety Research*, GAO-12-427 (Washington, D.C.: May 21, 2012); and GAO-13-584.

review and conducting the reviews, the agencies may enhance their ability to obtain useful, comparable information about their effectiveness in responding to wildland fires, which, in turn, may help them identify needed improvements in their wildland fire approach. As a result, we recommended in our September 2015 report that the Secretaries of Agriculture and the Interior direct the Chief of the Forest Service and the Director of Interior's Office of Wildland Fire to (1) develop specific criteria for selecting wildland fires for review and for conducting the reviews as part of their efforts to improve their approach to reviewing fires and (2) once such criteria are established, revise agency policies to align with the specific criteria developed by the agencies. In their written comments on our report, the agencies generally agreed with our recommendations and stated that they were developing criteria for selecting fires to review and conducting reviews.

The Forest Service Has Faced Challenges in Its Efforts to Modernize the Large Airtanker Fleet, but Has Increased the Availability of Large Airtankers Since Our 2013 Report

In our August 2013 report, we found that the Forest Service faced challenges in modernizing the government's fleet of large airtankers—which had declined from 44 in 2002 to 8 in 2013—but since that report the agency has increased the availability of such aircraft, with some challenges remaining. Specifically, we found that the Forest Service planned to modernize the large airtanker fleet by obtaining large airtankers from various sources over the near, medium, and long terms, but that each component of this approach faced challenges that made the continued availability of such aircraft to meet national fire suppression needs uncertain.²¹ Since that report, some of these challenges remain, while others are no longer relevant. In addition, the Forest Service has increased the availability of large airtankers, in part by increasing the number of airtankers under contract.

We found in our 2013 report that, in the near term, the agency planned to rely on a mix of contracted "legacy" airtankers, including several P-2V Neptune aircraft—Korean War-era maritime patrol aircraft—as well as supplemental aircraft available through additional contracts and agreements with the military and with other governments.²² However,

²¹GAO-13-684.

²²The Forest Service and Interior have established agreements with the military and with other governments, such as those of Canada and the State of Alaska, to augment the national firefighting aircraft fleet during periods of heavy fire activity.

agency concerns existed regarding the availability, capability, and costs of these resources. For example, the agency had seven P-2V Neptune aircraft under contract, the ages of which made their availability throughout the entire 5-year contract period uncertain. Specifically, aircraft vendors told us they might need to retire some aircraft prior to the end of the contract period because of the cost of maintaining the aging aircraft. As of November 2015, six P-2V Neptune aircraft remained under contract to the Forest Service.²³

For the medium term, the Forest Service had awarded contracts for seven "next-generation" large airtankers that were expected to be faster and more up-to-date than the legacy aircraft. However, at the time of our 2013 report, it was uncertain when those aircraft would begin supporting fire suppression activities, in part because bid protests had delayed contract issuance and, at the time of that report, only one had completed necessary federal approval and certification processes to support fire suppression activities. Since then, according to Forest Service officials, six of these seven aircraft have completed the needed approval and certification processes.²⁴ The Forest Service has issued additional contracts for next-generation aircraft and, as of November 2015, the agency had a total of 20 privately-owned large airtankers under contract, according to Forest Service officials.²⁵ Seven of these airtankers were added under contract in September 2015.

For the long term, the Forest Service's plan included a shift from the agency's long-standing practice of contracting for, rather than owning, aircraft. Specifically, the Forest Service had indicated its long-term intention to obtain up to 14 Alenia C-27J Spartan transport aircraft through intergovernmental transfer at no initial cost if they were declared surplus by the military and to purchase other airtankers. In our 2013 report, however, we found that challenges existed regarding the retardant

²³The seventh P-2V was damaged during a landing in 2014 and is no longer under contract, according to a Forest Service official.

²⁴Two of the aircraft received interim certification and are awaiting final certification, according to a Forest Service official.

²⁵The Forest Service contracted for these aircraft using exclusive-use contracts, which require a vendor to provide an aircraft for service on any day covered by a "mandatory availability period" stipulated by the contract. The agency can access additional aircraft using call-when-needed contracts, which allows the government to pay for firefighting aircraft only when they are used.

capacity and operating cost of the C-27J transport aircraft the Forest Service was to obtain through intergovernmental transfer, and that the Forest Service had been unable to justify previous plans for purchasing large airtankers to the Office of Management and Budget. Regarding intergovernmental transfer, the Forest Service had expressed interest in obtaining up to 14 Alenia C-27J Spartan transport aircraft from the Department of Defense if they were declared surplus equipment. Since our report, the National Defense Authorization Act of 2014 required a different intergovernmental transfer than that anticipated by the Forest Service—thereby making the challenge we identified with the C-27J transport aircraft no longer relevant.²⁶ Rather than transferring the C-27J transport aircraft to the Forest Service, section 1098 of the act directs the Coast Guard to transfer seven Lockheed Martin HC-130H Hercules aircraft to the Forest Service for use in wildfire suppression.²⁷ According to Forest Service officials, none of these aircraft have been transferred as of November 2015; these officials told us they expect the aircraft will be transferred to the Forest Service between 2017 and 2019. One aircraft, however, was used by the Forest Service during the 2015 wildland fire season under an agreement with the Coast Guard, according to Forest Service officials. The Forest Service equipped that aircraft with a Modular Airborne Firefighting System (MAFFS) unit—a portable, pressurized retardant delivery system.²⁸ However, as we found in our 2013 report, Forest Service and Interior officials expressed concern that MAFFS performance can be inadequate in some circumstances.²⁹ Forest Service officials told us the agency intends to operate one HC-130H aircraft with

²⁶ Pub. L. No. 113-66, 127 Stat. 881 (2013).

²⁷ The law directed that the aircraft first be transferred to the Air Force for certain needed modifications. Once these modifications are completed, the aircraft are then to be transferred to the Forest Service.

²⁸ The Forest Service has used MAFFS units to temporarily convert military C-130 aircraft into large airtankers when additional aerial firefighting capacity is needed, under an agreement with the Department of Defense. For more details on the MAFFS program, see GAO-13-684.

²⁹ We noted in our 2013 report that some federal and state fire aviation officials told us that the retardant line dispersed by the MAFFS system is generally narrower than firefighters prefer, which can either allow a fire to jump across the retardant line or necessitate an additional drop to widen the line, if another aircraft is available. Additionally, some officials said the system is unable to penetrate dense forest canopies, thereby preventing the retardant from being effective when used in heavy timber. However, some federal and state officials told us that MAFFS can be used effectively on rangeland where grasses are the predominant fuel type.

the MAFFS unit through the 2016 fire season, but the agency plans to equip all seven HC-130H aircraft with traditional gravity-fed retardant delivery systems. Forest Service officials told us that the expected service life of these aircraft is 6 to 12 years, after which time the Forest Service would likely need to invest in significant maintenance given the demands placed on the aircraft by the firefighting mission.

In another development since our 2013 report, the Consolidated and Further Continuing Appropriations Act, 2015,³⁰ included \$65 million "for the purpose of acquiring aircraft for the next-generation air tanker fleet to enhance firefighting mobility, effectiveness, efficiency, and safety." In August 2015, the Forest Service issued draft specifications for aircraft it would consider purchasing in accordance with the act. In November 2015, Forest Service officials told us the Department of Agriculture is preparing a business case to demonstrate the feasibility of such a purchase as required by Office of Management and Budget guidance, but did not provide a time frame for its submission.

Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff members have any questions about this testimony, please contact me at (202) 512-3841 or fennella@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Other individuals who made key contributions to this testimony include Steve Gaty (Assistant Director), Ulana M. Bihun, Mark Braza, Richard P. Johnson, Kyle M. Stetler, and Kiki Theodoropoulos.

³⁰Pub. L. No. 113-235, 128 Stat. 2130 (2014).

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 website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube. Subscribe to our RSS Feeds or E-mail Updates. Listen to our Podcasts and read The Watchblog. Visit GAO on the web at www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800, U.S. Government Accountability Office, 441 G Street NW, Room 7149, Washington, DC 20548



Please Print on Recycled Paper.

The CHAIRMAN. Thank you, Ms. Fennell.
Mr. Maisch, welcome.

**STATEMENT OF JOHN "CHRIS" MAISCH, STATE FORESTER
AND DIRECTOR, DIVISION OF FORESTRY, ALASKA DEPARTMENT OF NATURAL RESOURCES**

Mr. MAISCH. Good morning, Chairman Murkowski and Ranking Member Cantwell and members of the Committee. My name is Chris Maisch. I'm the State Forester and Director of the Alaska Department of Natural Resources Division of Forestry and past president of the National Association of State Foresters (NASF). The NASF represents the directors of the state forestry agencies in all 50 states, eight territories and the District of Columbia.

This was another difficult wildland fire season for us nationally, and in Alaska it will go down in the record books as the second worst season for acres burned. Approximately 5.1 million acres or about 54 percent of the 9.4 million acres that burned nationally this year were in Alaska. The worst fire season on record for Alaska occurred just over a decade ago at 6.4 million acres a year.

And if you would, please look at Figure 1 in your handout. As you examine the graph you will see a dashed line that indicates the rolling 11-year average for acres burned, and you can see that 2004 was the tipping point for the state. The workload, as represented by acres burned, has doubled from the previous long term average and this past season underscored the type of wildland fire season we are faced with on a more frequent basis.

I also have to tell you a personal story. It was the year my red beard turned grey in 2004. [Laughter.]

Our season began this year with two large urban interface fires, the Sockeye near Willow and the Card Street near Soldotna. The Sockeye fire was initially attacked at two acres and was 1,000 acres by the end of the day, and by the end of the second day it was 9,000 acres. Unfortunately over 100 structures were lost including 55 primary residents.

These incidents were a sign of things to come, and in mid-June in a 7-day period over 61,000 lightning strikes ignited 295 fires. And that's Figure 2 in your handout. By the end of the season 45 states and two Canadian provinces had provided resources to Alaska fires.

While all this activity was taking place in Alaska, the lower 48 season began to develop into a more active and challenging series of incidents. Many of the Western states, particularly Oregon, Washington and California, were having another difficult fire year.

So what did we learn from this past season and what can we do to address these growing problems?

Communities at risk. In FY2013 the total number of communities at risk from wildland fire in the U.S. was 72,000. The NASF is a key partner in the development and implementation of the National Cohesive Wildland Fire Management Strategy and its three primary goals: restore and maintain resilient landscapes, develop fire adapted communities, and provide efficient and effective responses to wildfires.

I'd like to illustrate the importance of these objectives by sharing a story about the Funny River fire from the 2014 Alaska fire sea-

son. The Kenai National Wildlife Refuge has been creating fuel breaks. These are large landscape level projects designed to protect homes, businesses and other values at risk should a fire start on the refuge and move toward the community. Take a look at Figure 4 for a picture of one.

These advanced preparations paid off and in the spring of 2004 a lightning initiated fire threatened the outskirts of Soldotna. The fuel breaks made all the difference. The call came in around midnight that the fire was going to hit the Funny River Road. By the time crews arrived there was not much time to start a burn out to rob the approaching fire of fuel. The fuel breaks slowed the fire and allowed crews to safely and successfully light a burn out. Over 2,400 structures were protected with an assessed value of more than \$250 million.

Next I'd like to talk briefly about another topic, and this topic has to do with our aviation programs. An ongoing problem for many states with wildland fire aviation programs is the issue of carding both individual pilots and aviation platforms.

Both the Forest Service and the Department of Interior, through their Office of Aircraft Services, require additional verification of any aviation assets that will be used on a Federal fire. The two agencies are not well coordinated in this effort despite using the same carding standards for certification and this caused some real problems during the fire season.

In my written testimony I've listed several specific examples to illustrate the issue, but I'd like to share two with you from my home state. A State of Alaska contract helicopter that is based out of California had been carded at the beginning of the fire season by the Forest Service and had to be re-carded by OAS when it reported to Alaska for work later in the summer. Also in Alaska two National Guard Blackhawk helicopters doing bucket work on a Forest Service fire were not utilized for a second mission when it was determined they were not carded.

These examples illustrate some of the challenges faced by states this season and the Federal agencies should engage State forest agencies as equal partners to update the National Wildland Fire Aviation Strategy with an efficient and consistently implemented approval process.

I see my time is short so I'd encourage you to examine two other general topics in my written testimony where I've made some recommendations for improving or maintaining programs that help grow and maintain response capacity and the need for more proactive forest management to help address some of the underlying causes of this problem.

In conclusion, thank you for the opportunity to appear before the Committee today. My fellow state foresters and I stand ready to assist the Committee at finding ways to address the challenges we all face as the wildland fire problem continues to grow and consume larger and larger portions of our State and Federal budgets.

Thank you.

[The prepared statement of Mr. Maisch follows:]

**Testimony of John “Chris” Maisch, Alaska State Forester
On Behalf of the Alaska Division of Forestry and
The National Association of State Foresters**

Submitted to the U.S. Senate Committee on Energy and Natural Resources

November 17, 2015

Good morning, Ms. Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee. My name is Chris Maisch, State Forester and Director of the Alaska Department of Natural Resources, Division of Forestry (DOF) and past President of the National Association of State Foresters (NASF). I appreciate the opportunity to speak with you today and submit written testimony as the Committee entertains an after action review of the 2015 fire season and the complex issues surrounding wildland fire management. The mission of the DOF is to proudly serve Alaskans through forest management and wildland fire protection. The DOF is the lead agency for wildland fire management services on 150 million acres of land with a primary goal to protect life and property. In addition, the agency oversees the management of 47 million acres of forests on state land, including approximately two million acres in three designated state forests. The Division also regulates commercial forestry practices on private, municipal and state lands with a mandate of protecting fish habitat and water quality during timber management activities.

The NASF represents the directors of the state forestry agencies in all 50 states, eight territories, and the District of Columbia. State Foresters deliver technical and financial assistance, along with protection of forest health, water and wildfire for more than two-thirds of the nation’s forests. While the duties of state agencies vary from state to state, all share common forest management and protection missions and most have statutory responsibilities to provide wildland fire protection on all lands, public and private. In fiscal year (FY) 2014, state forestry agencies provided this service on approximately 1.5 billion acres and helped train nearly 102,000 firefighters via funding from the USDA Forest Service (Forest Service), State Fire Assistance (SFA) and Volunteer Fire Assistance (VFA) programs. State Foresters work closely with federal partners to deliver forestry programs and wildfire protection.

2015 Wildland Fire Season

This was another difficult wildland fire season nationally, and in Alaska it will go down in the record books as our second worst fire season for acres burned. Approximately 5.1 million (M) acres or about 54 percent of the 9.4M acres that burned nationally this year were in Alaska. The worst fire season on record for Alaska occurred just over a decade ago (2004) at 6.4M acres (Figure 1). As you examine the graph, you will see a dashed line that indicates the rolling 11-year average of acres burned and you can see that 2004 was a tipping point for the state. The workload as represented by acres burned has doubled from the previous long-term average and this past season underscored the type of wildland fire season we are faced with on a more frequent basis.

The Alaska season unfolded with a very dry and warm spring that cured the fuels and set-up the potential for a significant fire event should ignition sources develop, which for Alaska is usually lightning in June. Many of our fire/fuel indices were at record or near record levels around the state. The season started in earnest with two large, urban interface fires, one in the Matsu Valley near the community of Willow, called the Sockeye fire, and the other on the Kenai Peninsula near the town of Soldotna, called the Card Street fire. Both of these incidents occurred during fire weather red flag warnings, which was primarily due to predicted high winds. The Card Street fire was reported at one acre and grew to 1,000 acres on the first day - 9,000 acres by the second day. The Sockeye fire was initially attacked at two acres and by the second day the fire had grown to 6,500 acres. Unfortunately, there were 59 primary residences lost, mainly in the Sockeye fire. These incidents were a sign of things to come and in mid-June a seven-day lightning event ignited 295 fires (30 to 50 per day) when over 61,000 lightning strikes occurred (Figure 2). Needless to say, the Alaska wildland fire suppression resources were down to nil by the end of this unprecedented seven day run, despite the pre-positioning of resources that had been done in anticipation of a large fire event.

Assistance was coming from the Lower 48 states (L-48) and Canada, but it takes several days for resources to arrive. On June 17th there were 999 staff assigned to fires, 2,000 by June 23rd and 3,174 staff by June 29th. By the end of the season, 45 states and two Canadian provinces had provided resources to Alaskan fires. Roughly speaking, about 48 percent of the resources used were Alaskan based with the balance (52 percent) coming from other state, federal and Canadian sources. This example underscores the importance of the sharing of wildland fire resources and building capacity of both state and local cooperators to respond nationally during extreme events.

As the season progressed, over 90 fires merged, with the largest being the Big Creek Two fire, which joined with four other fires that totaled 433,685 acres. At one point, two rural communities, Tanana and Koyukuk on the Yukon River, were surrounded by a complex of fires. At the time I was reminded of the town of Wallace, Idaho that was destroyed in the infamous 1910 fire known as the "Big Burn." Fortunately in this case, losses were kept to a minimum by a key interagency partner the Alaska Fire Service, but many of the residents of these two villages were evacuated for an extended period of time. In the end, there were 766 fires statewide and the state was at planning level five for 24 days - the highest level of activity. Luckily, the month of August had abundant rainfall in many locations around the state and there were few new fire starts. However, there was plenty of fire on the landscape, and fire fighters were continuously assigned to fires from May 16th until September 10th, a very long fire season for Alaska. The last major fire of the season was on Kodiak Island, another wind driven fire that reached 5,000 acres in just two days. The fire burned all the way to the ocean, where it finally stopped! (Figure 3).

While all this activity was taking place in Alaska the L-48 fire season began to develop into a more active and challenging series of incidents. Many of the Western states, particularly Oregon, Washington and California were having another difficult fire year and this was on the heels of a record-breaking year for two of these states in 2014 (WA and OR). There were 53,798 wildfires reported nationally between January 1st and October 30th with the number of acres burned exceeding the ten-year average (6.5M acres) by almost 3.0M acres. My colleague, California State Forester Ken Pimlott, has indicated to me that due to drought in his state, they

now have a year round fire season. The issue of wildland fire is not just a Western U.S. problem. As you look around the nation you have difficult and challenging fire seasons from all jurisdictions but fortunately so far, not usually in the same years. So, what did we learn from this past season and what can we do to address this growing problem?

Communities at Risk

In FY 2013, the total number of communities at risk from wildland fire in the U.S. was more than 72,000. During the same year approximately 17,000 communities have completed Community Wildfire Protection Plans (CWPP). Last week there was a fire chiefs White House roundtable on climate change and the impacts at the wildland urban interface (WUI). There is a growing recognition that what was once considered unusual or extreme for an individual fire, or the duration and intensity of a fire season, is becoming more common place.

The NASF is a key partner in the development and implementation of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) and its three primary goals:

- Restore and Maintain Resilient Landscapes
- Develop Fire Adapted Communities
- Provide Efficient and Effective Response to Wildfires

I believe members of this Committee are familiar with these concepts and you will hear from other speakers today on some of the details of these three goals, so I'd like to illustrate the importance of these objectives by sharing a story about the Funny River fire from the 2014 Alaska fire season. I think many of my fellow State Foresters could share similar stories from their experiences. I don't believe this is a unique example.

The Kenai National Wildlife Refuge has been creating fuelbreaks – these are large landscape level projects. These projects were part of an interagency and multi-landowner effort to design and construct fuelbreaks that would protect homes, businesses and other values at risk should a fire start on the refuge and move toward the community (Figure 4-5). The DOF was a key partner and completed the on-the-ground treatments over the course of several years. At the same time, individual fuel mitigation projects were pursued with homeowners utilizing the FireWise program as part of the overall implementation of the communities CWPP. These advanced preparations paid off and in the spring of 2014 a lightning initiated fire threatened the outskirts of the town of Soldotna, in an area called the Funny River Road.

On the Funny River thick plumes of smoke dominated the skyline as firefighters dispersed through subdivisions. Some people had already been evacuated and the entire area was now under an evacuation order. People streamed out the one highway that leads into the area. The community was sandwiched between the approaching fire and the Kenai River, with only one way in and out. It was also the start of the Memorial Day weekend and this was the last thing most people had on their minds a few days earlier. Now they were wondering if they would have a home to which they could return. Moving fast on multiple fronts, firefighters were looking for any break they could get.

The fuelbreaks made all the difference. The call came in around midnight that the fire was going to hit the Funny River Road. By the time crews arrived, there was not much time to start a burn out to rob the approaching fire of fuel. For the Incident Commander the question was where to start? “Suddenly I realized I was in an area that was thinned of trees; they had built a fuelbreak!” he said. “The fuelbreak slowed the fire down enough for crews to safely and successfully light the burnout.” Over 2,400 structures were protected with an assessed value of more than \$250M.

This incident illustrates a number of key elements of successful fire management: advanced preparations made by communities and individual homeowners, proactive management of high risk fuels by state and federal agencies, and an interagency “all hands, all lands” approach.

Nationally and in Alaska, there is not enough funding being allocated for high risk fuels mitigation work. Each year in rural Alaska there is at least one fire in the wildland that is caused by burning at the local land fill. This year, there were two and these types of ignition sources are preventable, but only if humans cooperate. To improve the odds of eliminating these types of ignitions, every land fill in rural Alaska should have fuel mitigation projects completed around the facilities and a CWPP for the community completed. This investment would be paid back rapidly; consider that the two fires from this season alone cost over \$7.0M to control.

Aviation and Wildland Fire

The national shortage of air tankers is finally moving in the right direction with the development of new platforms and resources, including next generation air tankers (Figure 5). These aviation assets are a key part of initial attack operations, to keep fires small, but are also deployed on larger project fires. The key to using air tankers in this role is using the right tool for the job and ensuring there are ground forces available to back-up the use of retardant and water drops. Attempting to build line with air tankers might look good, but this is an expensive resource and operation staffs on the fire line need to ensure the impact on control efforts is worth the cost (Figure 6).

An ongoing problem for many states with wildland fire aviation programs is the issue of “carding” individual pilots and aviation platforms. Both the Forest Service and the Department of Interior (DOI) fire suppression agencies, thru their Office of Aircraft Services (OAS), require additional verification of any aviation asset that will be used on a federal fire. The two agencies are not well coordinated in this effort, despite using the same carding standards for certifications. States have a combined aviation fleet of 197 fix wing aircraft and 184 helicopters in addition to their National Guard assets and this inter-agency situation has caused some real problems during the fire season and I’ve highlighted several here:

- A state of Alaska (AK) contract helicopter that is based out of California (CA) had been carded at the beginning of the fire season by the Forest Service and had to be re-carded by OAS when it reported to AK for work.
- Colorado sent its multi-mission aircraft (infrared mapping), which was approved by the Forest Service in its Region-2, to Oregon (OR) where it had to be carded again by Forest

Service Region-6. It was approved within a couple of days, but this second action should not be required.

- Nevada was required by OAS to add a second digital radio to an aircraft, which is not in the current standards.
- In OR, additional issues included delays in receiving a tanker identification number for a state Single Engine Air Tanker (SEAT) and National Interagency Fire Center (NIFC) staff initially refusing to load NIFC radios onto an OR state aircraft to transport back to OR. An email authorization was required from the Forest Service, Region-6. This was a time sensitive issue due to ongoing wildfires.
- In Montana (MT), state FEPP helicopters can't be carded due to interpretation on maintenance practices (i.e. Ex-military vs. Federal Aviation Administration standards).
- In AK, two National Guard Black Hawk helicopters doing bucket work on a Forest Service fire were not utilized for a second mission when it was determined they were not carded.
- Multiple states including CA, OR, WA, Idaho and MT activated numerous National Guard Type 1 and Type 2 helicopters this past summer.

These examples illustrate some of the challenges faced by states this season and the federal agencies should engage state forestry agencies as equal partners to update the National Wildland Fire Aviation Strategy, and clarify language in the memorandums of understanding, cooperator standards and mobilization guides to facilitate continued interagency use of state aircraft with an efficient and consistently implemented cooperative approval process.

State and Local Wildland Fire Responders

The Forest Service (SFA) and (VFA) programs are the fundamental federal assistance programs that states and local fire departments use to develop preparedness and response capabilities for wildland fire management. They provide crucial financial and technical assistance to support state and local fire management activities, including preparedness, planning, training, hazardous fuels treatments, and the purchase and maintenance of equipment.

Continued support and sufficient funding is needed for the SFA and VFA programs. These programs' recognize the essential role of state and local government in responding to and managing wildland fires and help to ensure these entities can respond effectively to wildland fires on all jurisdictions.

In FY 2014, the SFA program directly funded hazardous fuel treatments on 111,002 acres (with another 120,241 acres treated with leveraged funding) and provided assistance to communities around the country, supporting 3,117 risk assessment and fire management planning projects and 9,972 prevention and education programs. However in many states and localities, funding cuts have drastically impacted wildfire emergency response and preparedness capacities. Recent changes to the national VFA funding allocation methodology caused a 75 percent decrease in grants to rural Alaska fire departments.

There are two additional programs critical for supporting the capacity of state and local agencies; the Federal Excess Personal Property (FEPP) program and the Firefighter Property Program (FFP). Over a five-year period (2008-2012) this program delivered more than \$150M annually in equipment used to fight wildfires.

The FEPP Program loans federally owned property to state forestry organizations and their cooperators for use in responding to wildfire. This includes equipment such as trucks, fire tools, hoses, vehicle parts, nozzles, generators, air compressors, fire protection clothing, aircraft, and aircraft parts. While the FFP gives firefighters access to Department of Defense property for use in firefighting and other emergency services. Further, FFP allows ownership to pass from the federal government following a specified period of use.

These two programs are crucial to rural communities and for many small fire departments as federal excess equipment may be the only affordable equipment available to them. States and local fire departments are more often the first responders to fires – they utilize the equipment these federal excess property programs provide to keep wildfires small and contained, provide major cost-savings to states and their cooperators, and offer the critical protection for adjacent communities.

Continued federal assistance is needed so that all these programs will continue to help the many thousands of communities at risk to prepare for and mitigate the risks associated with wildland fire.

Proactive Forest Management and Cost of Wildland Fire Suppression

While not a focus for this hearing, members of this Committee are aware the Forest Service once again exhausted its available fire suppression funds to fight wildfires and was forced to transfer \$700M in FY 2015 from non-fire programs to pay for fire suppression costs. This interferes with ongoing work in the field and delays or completely stops new contracts for all types of activities including those that contribute to reduced wildfire risk across forested and rangeland landscapes. This is the eighth time since 2002 that the Forest Service has needed to invoke its transfer authority to pay for shortfalls in fire suppression needs. In total, the agency spent \$1.7 billion on fire suppression in FY 2015 and in Alaska the state spent a record \$82M to \$84M this fire season. Meanwhile, the DOI has had to transfer funds from non-fire programs to pay for fire suppression six times since 2002, though fortunately DOI did not have to carry out fire transfers in FY 2015.

Fire transfers represent just one part of the broader wildfire funding problem. In recent years, the portion of the Forest Service and DOI budgets allocated to fire programs has grown while the overall budgets for the agencies have remained relatively flat. As more funding is allocated to fight fires, less is allocated to other areas of the Forest Service and DOI budgets. Suppressing fires is becoming more expensive and complex as a result of prolonged drought, lack of active forest management, and more people moving into WUI areas. As an example, in 1995 the Forest Service's fire programs budget represented 16 percent of the agency's total budget; in 2015, over 50 percent of the agency's total budget was dedicated to fire.

The NASF urges Congress to enact a permanent solution this year to resolve the wildfire funding problem. Specifically, NASF supports a solution that allows access to disaster funding, eliminates the negative impacts of transfers on other programs, and addresses the increasing costs of fire suppression. NASF supports the bipartisan Wildfire Disaster Funding Act (S.235, H.R.167) along with a diverse group of over 260 other organizations. NASF greatly appreciates the recognition by members of this Committee and others in Congress that the current budgeting framework and status quo for wildfire suppression funding is broken. We welcome the opportunity to work with Congress to identify a bipartisan solution.

Conclusion

Thank you for the opportunity to appear before the Committee today on behalf of the Alaska Division of Forestry and the National Association of State Foresters. Wildland fire response is one of the most challenging facets of our jobs. The NASF and I stand ready to assist the Committee in finding ways to address the challenges we all face as the wildland fire problem continues to grow and consume larger and larger portions of our state and federal budgets. Finally, I would like to thank the Committee for its continued leadership and support of efforts to both respond to wildland fire and to take the necessary actions to address the underlying causes through increasing active management of all forestlands.

Attachments

Figures 1-7

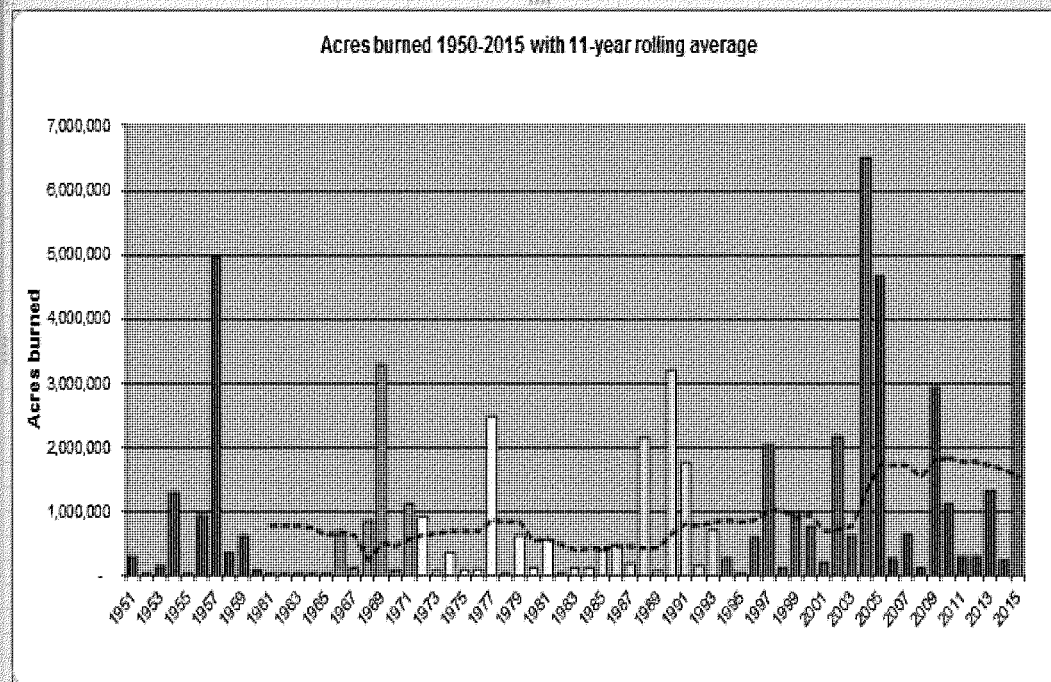


Figure 1.- History of acres burned by year in Alaska with rolling average by eleven year increments. Note the significant jump in the running average that began in 2004.

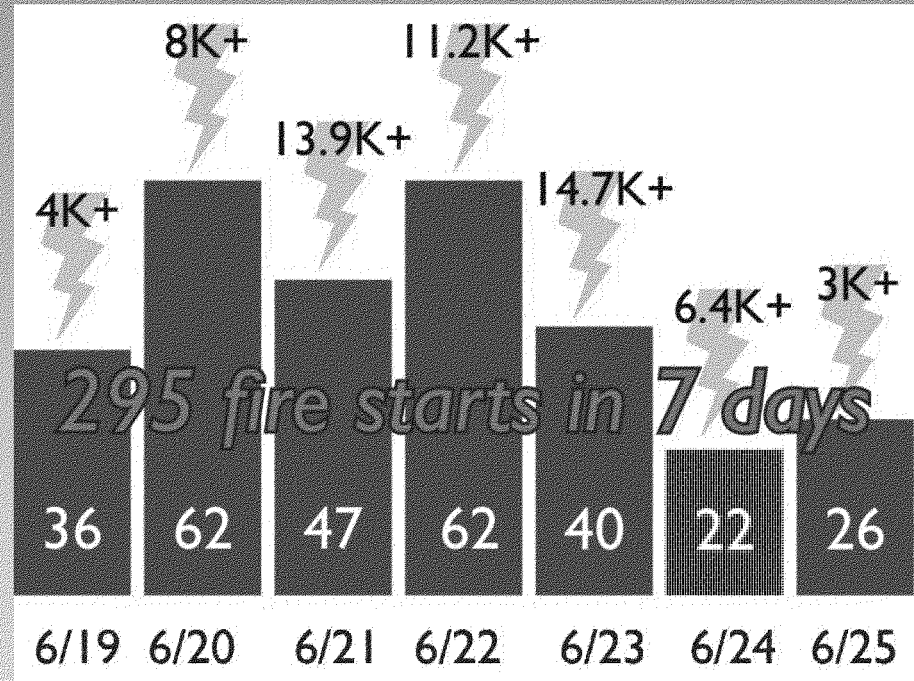


Figure 2.- Number of lighting strikes (61K) across Alaska during a critical seven day period in the 2015 fire season and the number of new fire starts each day.

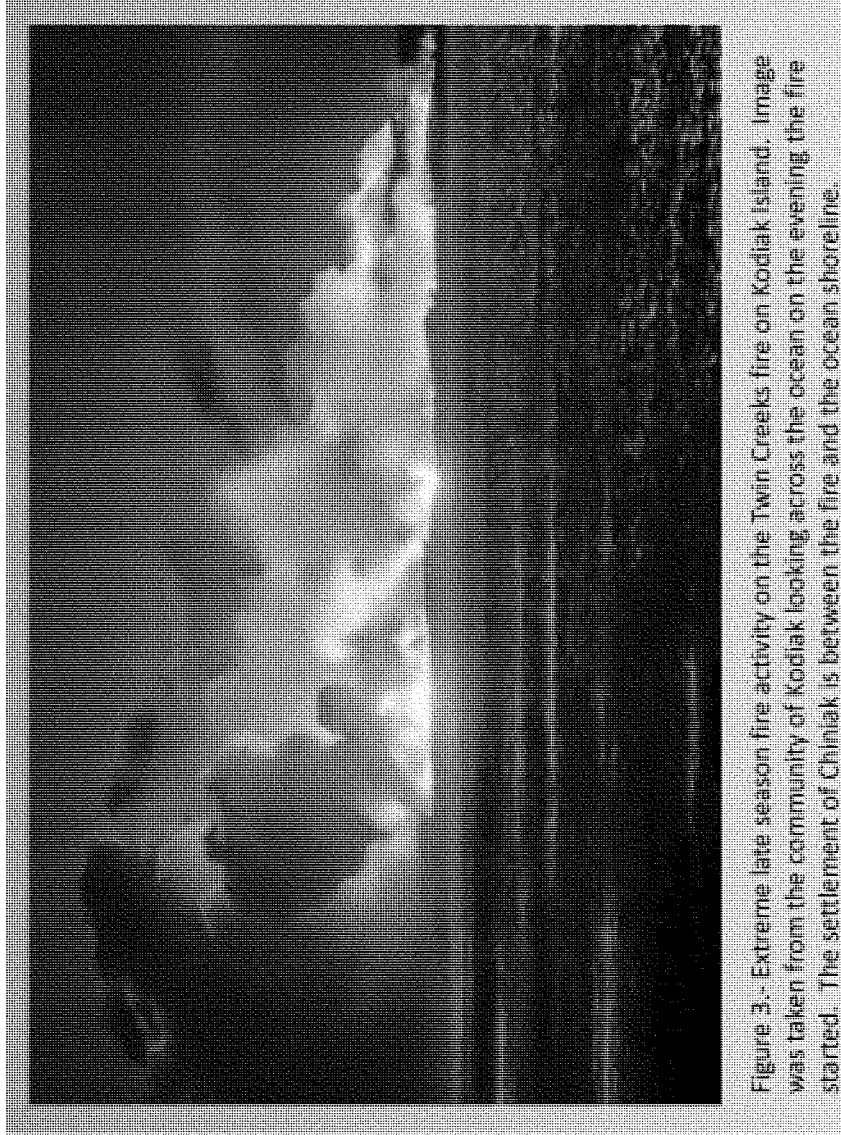




Figure 4.- A portion of the fuel break near the Funny River Road that was utilized in a burn out operation during the Funny River Fire.

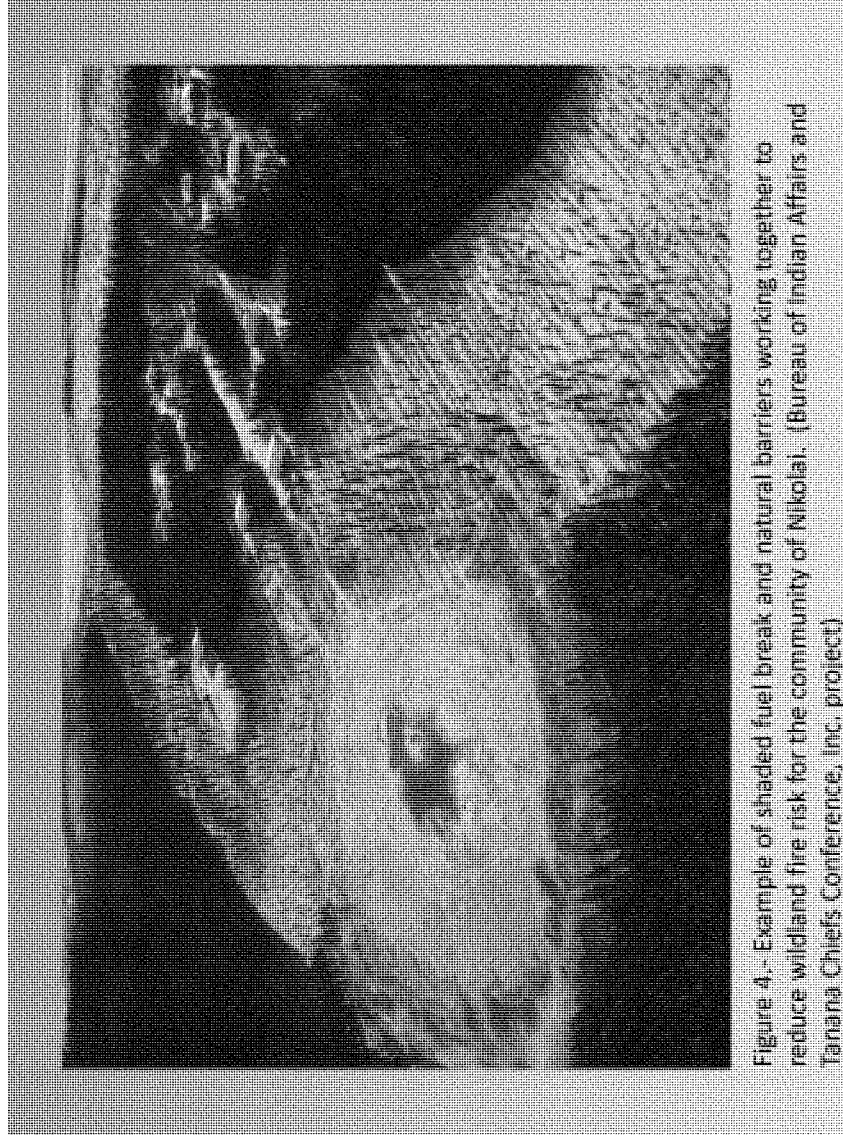
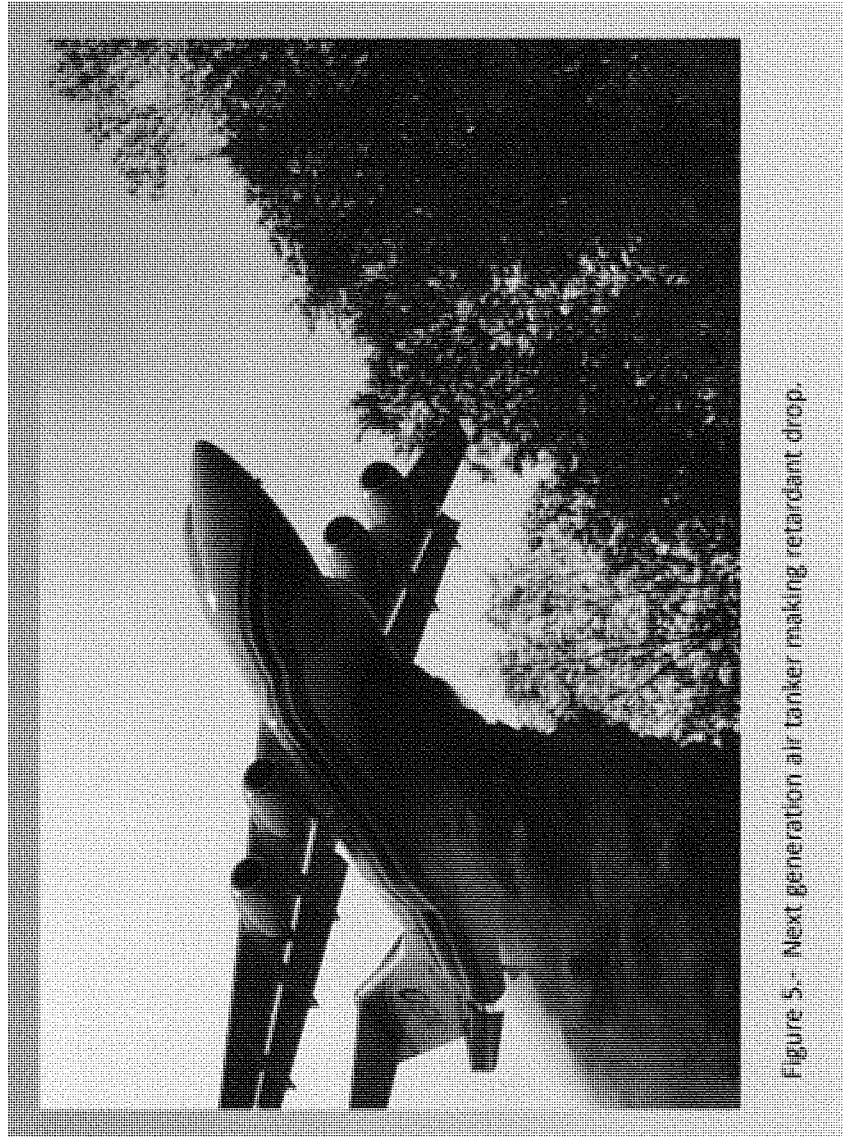


Figure 4.- Example of shaded fuel break and natural barriers working together to reduce wildland fire risk for the community of Nikolai. (Bureau of Indian Affairs and Tanana Chiefs Conference, Inc. project)



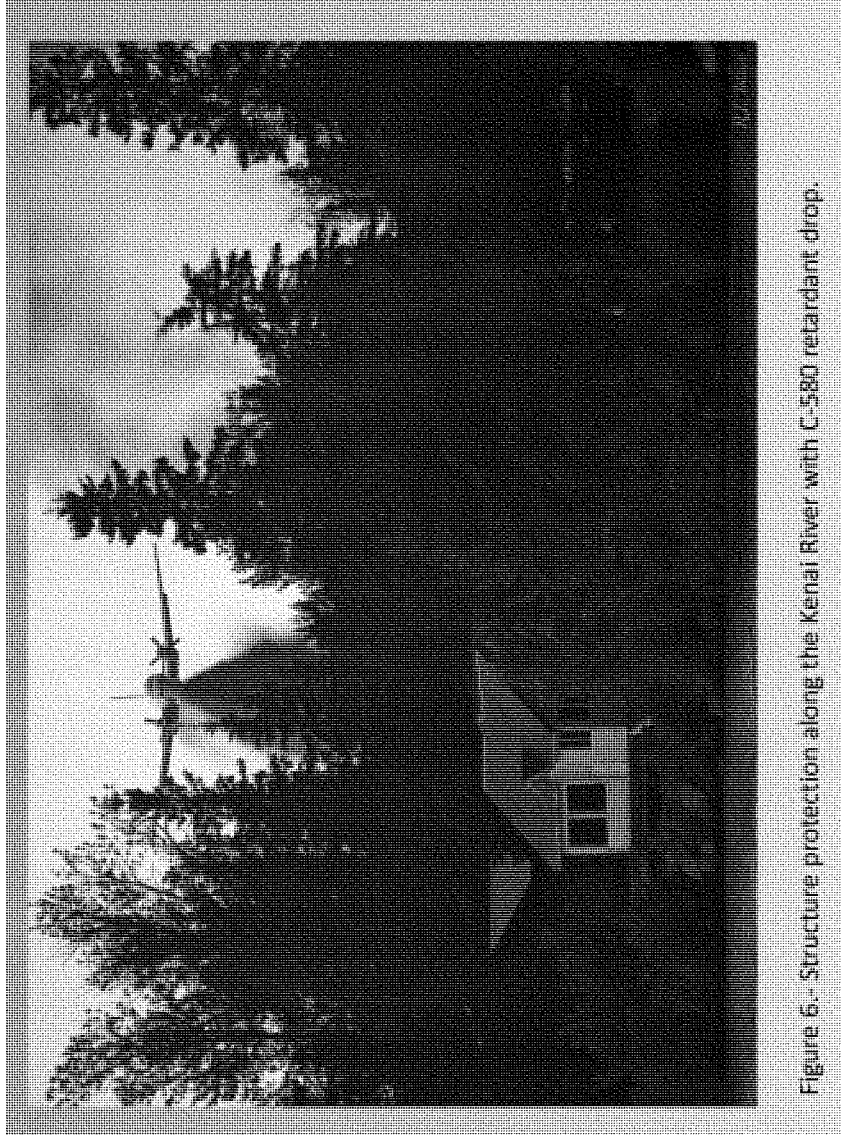


Figure 6.- Structure protection along the Kenai River with C-580 retardant drop.

The CHAIRMAN. Thank you, Mr. Maisch.
Dr. Covington, welcome.

STATEMENT OF DR. WILLIAM WALLACE COVINGTON, REGENTS' PROFESSOR OF FOREST ECOLOGY, AND DIRECTOR, ECOLOGICAL RESTORATION INSTITUTE, NORTHERN ARIZONA UNIVERSITY

Dr. COVINGTON. Chairman Murkowski, Senator Cantwell, members of the Committee, thank you so much for the opportunity to testify before you today about a problem that's important to all of us. It's been important to me for almost 50 years now.

My name is Wally Covington. I'm Regents' Professor of Forest Ecology at Northern Arizona University (NAU) and Executive Director of the Ecological Restoration Institute which was established in 2004 by Federal authorizing legislation. We have three institutes, one at Arizona, one at Colorado and one at New Mexico. All of them, working together to provide the best available information that can be had for restoring forest health and preventing the kinds of devastating fires that we're talking about today.

Being at NAU for over 40 years now I have had the opportunity to teach fire ecology and management, wildlife forest operations, virtually any topic in the area of forestry and I've also conducted research, primarily fire-based research, confronting the problem of steadily increasing wildfires.

In 1976 I'd been there for just a year when my house was threatened by a fire which was then called the biggest and most devastating fire in Arizona history. It was almost 4,700 acres. And then during this 40 years I've seen these increasing gradually, you know, to 10,000, 20,000, 50,000, and now hundreds of thousands of acres.

At no great surprise we've seen a couple of things happening.

One is that we see fuel building up in the understory of frequent fire forests, like Ponderosa Pine forests. And then in forests that naturally have catastrophic fires like Lodgepole Pine, Spruce, Fir, interior Alaska forests, we see landscapes becoming more and more homogenous. So larger and larger patches of the land are available to burning.

The other thing that has driven this clearly has been an increase in the severity and duration of fires, of the fire season. We're now seeing fires burn in at times of the year that are completely unprecedented. We have fires now, we've had fires in Arizona called the January fire and the February fire because we never had fires during that period of time. And now they're coming. They can burn just about any time of year.

So my testimony then has five major points, and I'm just going to highlight that briefly.

The disruption of natural fires has resulted in a shift in fire regimes and frequent forest types like Ponderosa Pine from surface fires to crown fires. The attempted suppression of fire in areas that are naturally catastrophic fires, like I mentioned before, has resulted in more homogenous landscapes that require heroic efforts to try to suppress.

My final point is that the research has shown that there are things we can do about it. One in crown fire regimes where fires

are natural, we can break up fuel continuity with fire breaks. You thin it out. You make it so that instead of a million acres being available to burn, maybe you have 50,000 acres available to burn. That's one approach.

In frequent fire forests you need to thin across the landscape and remove the excess trees that have come in since fire suppression, conserve the old growth trees and then start burning on a natural cycle. In that way these forests are consistent with their evolutionary environment, no threat to endangered species. Watersheds are protected and so on.

We've looked at fires post fire. We've had, as you know, some very large fires in Arizona, half million acres plus. And one of the projects that has been particularly instructive to us was to look at the wall of fire, post wall of fire, look at what happened there and then use a Forest Service developed fire behavior models to determine what the fire behavior would have been had treatments been put in place beforehand, different treatments than we had.

What we found was that if you just focused on urban wildland interface treatments, you could reduce the fire size by about 12 percent. You could reduce flame lengths by about 6 percent. However, if you strategically located these treatments across the entire landscape, you could reduce the size of the area burned under high severity by 40 percent and flame lengths by 30 percent.

So in closing I'd just like to say that there is strong science available to help inform how we can do these preventive treatments, and using that science we have demonstrated, as have others, time and again that an ounce of prevention is worth a pound of cure. If you invest up front you can save houses, you can protect lives, and you can restore landscapes for current and future generations.

Thank you.

[The prepared statement of Dr. Covington follows:]

William Wallace Covington
Regents' Professor of Forest Ecology and
Director, Ecological Restoration Institute
Northern Arizona University

Testimony before the Committee on
Energy and Natural Resources
U.S. Senate
Hearing to Review Past Wildfire Seasons to Inform and
Improve Future Federal Wildland Fire Management Strategies

November 17, 2015

Chairman Murkowski, Senator Cantwell, and members of the Committee, thank you for this opportunity to testify on a subject of personal importance to me and of critical importance to the health of our nation's forests and the people and communities that depend upon them.

My name is Wally Covington. I am Regents' Professor of Forest Ecology at Northern Arizona University and Director of the Ecological Restoration Institute.

I have a Ph.D. in forest ecosystem analysis from Yale University and have been a forestry professor at NAU since 1975.

Over the past 40 years I have taught graduate and undergraduate courses in ecological restoration, ecosystem management, fire ecology and management, forest management, range management, wildlife management, watershed management, and forest operations research. During that same period I have worked on long-term research in fire ecology and management in ponderosa pine, mixed conifer and related ecosystems. In addition to my publications on forest restoration, I have co-authored numerous scientific papers on a broad variety of topics in forest ecology and resource management including research on fire effects, prescribed burning, thinning, range management, wildlife, forest health, and natural resource conservation.

My testimony has five main points:

1. The disruption of natural fire regimes across the western U.S. has created excess fuels and the rise of megafires;
2. A restoration-based approach including thinning and prescribed burning is imperative to safely reduce fuels and restore forest health—it's too late for fire alone to restore most of the landscape;
3. We must act at the pace and scale of the problem if we are to restore our forests and protect communities from devastating and costly wildfires;

4. Best-available science and comprehensive analysis is necessary for informed decisions that address current fire and forest health problems; and
5. Strategic location of restoration treatments across landscapes and across jurisdictions is required.

Although the general principles that I will discuss apply to the vast majority of the West's dryer forest types, I will focus my testimony on ponderosa pine and dry mixed conifer landscapes. As the GAO has pointed out, over 90 percent of the severe crown fire damage nationally is in this forest type.

Megafires—unnatural fires that burn entire landscapes at scales of 100,000 to 1,000,000 acres are becoming the norm. Over the next 40 years the outlook is for increasingly large and severe fires with ever more devastating impacts on people and the rest of nature. Large scale restoration and management is absolutely essential for minimizing costs and maximizing benefits for current and future generations.

The Ecological Restoration Institute: Bridging the gap between science and action

The Ecological Restoration Institute at Northern Arizona University is a nationally recognized leader in forest restoration and wildfire. It was authorized by Congress in 2004 (PL108-317) to assist land managers and diverse stakeholders to understand, implement and monitor practical science-based forest restoration treatments designed to reduce the risk of severe wildfires, improve the health of dry forest and woodland ecosystems, enhance watershed function, provide jobs, and improve the quality of life for communities and citizens in the West. Conducting scientific research, transferring the best available science, and reaching out to land managers and stakeholders are core functions of the ERI.

The cause of megafires

Wildfires in dry forest types have changed in size and severity to levels that would have been unthinkable even 15 years ago. Due to past management practices, dense, unhealthy forests are overstocked with flammable debris and provide ample fuel for high-severity crown fires that kill old-growth trees. These catastrophic fires are difficult and costly to contain, and can ignite hundreds of spot fires as far as 2 to 4 miles ahead of a blaze in high winds.

Research shows that, in addition to excess fuels, climate change is influencing the frequency and size of fires. One of the ways this is playing out is in the boom and bust of wet and dry seasons. During wetter years, fuels build up. As drought conditions set in during drier years, the abundant fuels become tinder dry, and when they ignite, the fires take off.

Disruption of natural fire regimes has caused a shift from natural surface fires to unnatural crown fires

Frequent low intensity surface fires, fires that burn through grassy understories with 2-3 foot flame lengths, shaped the plants and animals that constitute the dry forest types of the West. Over eons these natural fires occurred once every 2-20 years preventing tree population irruptions and excessive fuel accumulation and maintaining open, park-like landscapes maintained by frequent low intensity fires. Such fires are the central self-regulating mechanism in these landscapes.

Fire exclusion in frequent fire forests has resulted in tree population irruptions and steadily accumulating hazardous fuels over vast landscapes. Before settlement frequent fire forests typically supported stand densities of 15-75 trees per acre and fuel loads of 2-5 tons per acre. Today those same stands are choked with 300 to 1000 trees per acre in dense forests and have fuel loads of 20-80 tons per acre. These unnaturally dense forests with excess fuel accumulation now support unnatural crown fires—fires that burn through the tops of the trees killing them and stripping the land of protective cover that would otherwise prevent soil erosion and downstream flooding.

Crown fires are not consistent with the evolutionary environment of frequent fire landscapes. As such they pose the greatest threat to biological diversity, natural resource values, and the communities of the West.

It's too late for controlled burning alone to protect communities and restore forest health

These deleterious changes in dry forests were well known to ecologists and foresters since the 1940s. However, with few exceptions, little was done to reverse the trend of deteriorating forest conditions. In the 1950s, prescribed burning (controlled fires set by managers under specific conditions) showed promising results. But fuel accumulations were already so great in the 1950s that many of those fires were very difficult to contain.

By the 1970s when I started my research into how to reduce crown fire threats and restore forest health, I worked with the Forest Service, the Bureau of Land Management, and the National Park Service to initiate a set of long-term research and application projects designed to remedy the fuel accumulation problem. For the first six years we focused on trying to develop controlled burning prescriptions that would reduce surface fuels and thin out excess post-settlement trees. The results of these experiments were very disheartening. Although we were able to use controlled burns to reduce surface fuels, we could not find any conditions that would allow fire to thin post-settlement trees safely. In fact, instead of killing post-settlement trees, many of these fires killed the old growth trees which we sought to protect. Follow up research showed that smoldering combustion at the base of the old growth trees heated the base of the trees to lethal temperatures, girdling and killing them over time. Perhaps even more alarmingly, in several of the burns, fires climbed into the tree tops, threatening to escape. On several occasions it occurred to me that an escape fire might result in me becoming one of the shortest term appointments to the School of Forestry at NAU since its founding.

The discovery that controlled burning alone could not safely reduce fuels and restore forest health led us to develop a more comprehensive approach, one based on ecological restoration principles. Accordingly, we focused our efforts on an integrated research program that had two major components. First, we used historical ecology techniques and converging lines of evidence to determine what the natural forest densities and patterns were and what the fire regime was before settlement. Second, we initiated a set of controlled experiments consisting of mechanically thinning and removing the unnaturally high densities of post-settlement trees, protecting old growth trees, and then introducing surface fire.

The results of these restoration experiments were stunning. Old-growth trees which had become stagnated over the past century by competition with post-settlement trees began growing like teenagers. Previously sparse understories of grasses and wildflowers burst forth with a startling abundance of production and flowering, so much so that we had to install electric fences to keep elk and deer from hammering these small islands of lush vegetation. Butterfly and songbird abundance tracked increases in grass, wildflower, and shrub production. Importantly, hydrologic studies showed that snow pack increased (due to reduction of interception by excessive tree canopies), soil moisture improved, and more water made it beyond the rooting zone indicating that more could be available for spring and steam flow as well as ground water recharge. We are now working at watershed scales to quantify those effects.

Our ongoing work examines how different levels and patterns of thinning impacts fire behavior and resource conditions. Both published results and those in process indicate that restoration-based thinning—thinning that closely follows pre-settlement tree densities and patterns—and recurring fire approximating natural fire return periods provides the best overall results for simultaneously restoring forest health, enhancing watershed function, conserving biological diversity, and protecting communities. However, as more and more trees are left in departure from natural densities, the risks of unwanted effects increases markedly.

Naturally ignited wildland fires have potential for complementing mechanical thinning and prescribed fire to meet fuels reduction and restoration goals. However, at present there isn't adequate scientific evidence to support use of naturally ignited fires in dense forests as a reliable option for restoration at landscape scales. With the state of decline in forest health, current fuels accumulation, and uncharacteristic crown fire problems across the West, more research is needed to better understand strategies that bolster success of wildland fires for meeting ecological objectives across the landscape at all scales.

Another major emphasis of our work at ERI is developing research to support wood utilization, as well as biomass utilization, as ways to help offset the cost of restoration for some portions of landscapes. In general, we are examining how we can convert excess post-settlement trees and biomass which are a liability, into assets that can help rebuild natural resource-based economies (and jobs) for the West.

Strategic location of restoration-based fuel reduction treatments is essential

These results indicate that under ideal circumstances, comprehensive restoration based on localized knowledge of pre-settlement conditions would produce the most beneficial outcomes in landscapes dominated by dry forests. However, ideal conditions do not exist across large landscapes. In most circumstances, lack of funding, inadequate access, and lack of biomass or commercial wood utilization infrastructure dictates that comprehensive restoration will be limited in many circumstances to only 20-30 percent of the landscape.

This is where strategic location of treatments becomes paramount. Landscape modeling and analysis indicates that locating comprehensive restoration treatments to break up landscape fuel continuity is the best strategy. In such a manner highly valued landscape elements such as communities, critical wildlife habitats, key watersheds, and other vulnerable landscape elements can be protected by strategic allocation of fire suppression forces when an ignition occurs under extreme fire weather conditions.

Evidence exists that such an approach works.

Evidence from Arizona

Arizona is no stranger to megafires. The 2002 Rodeo-Chediski Fire and the 2011 Wallow Fire were two of the country's first massive wildfires to make national headlines—each burned nearly 500,000 acres of forest. Over the past five years, megafires have threatened many Arizona communities, particularly during the driest months of May and June.

Working with State and Private Forestry in the Washington Office of the Forest Service, Research Station researchers, and local Forest Service staff in 2012, we conducted an analysis of the Wallow Fire to estimate how strategic allocation of treatments might have changed fire behavior across the 538,000-acre Wallow Fire footprint. We already knew that Wildland Urban Interface, or WUI, treatments implemented by the Apache-Sitgreaves National Forest had saved several communities from catastrophic fire, but we also wanted to know whether implementation of nationally developed Forest Service fuel reduction priorities would have changed wildfire outcomes across the landscape.

Using a GIS based modeling approach based on fire hazard outputs and communities-at-risk we simulated Wallow Fire behavior under A) pre-fire existing conditions, B) conditions that would have existed with protection of communities-at-risk (WUI only) treatments, and C) conditions that would have existed with implementation of treatments in all high fire risk areas across the entire landscape.

The results indicate that treatment scenario B (treatments only in WUI) would have reduced crown fire potential across the landscape by 12 percent and flame lengths by 6 percent. In contrast, treatment scenario C (treatments in all high risk areas) would have reduced crown fire potential by 40 percent and flame length by 30 percent. This analysis supports the conclusion

that the risk of megafires is best addressed by not only treating around communities, but by treating away from them as well in the greater landscape as a whole.

How Arizona dodged two bullets during the 2014 wildfire season

In 2014, two fires had the conditions, and the chance, to burn hundreds of houses and destroy some of the state's most coveted recreational tourist attractions, but they didn't. Unlike the Rodeo Chediski and Wallow fires, these are the fires that didn't make the headlines.

Arizona's Slide Fire and San Juan Fire of 2014—which burned about 21,000 and 7,000 acres, respectively—are considered small, and almost insignificant by today's media standards. But they also provide examples of what the consequences of doing nothing could have been. Given the dry, hot, windy conditions at the times of ignition and the amount of fuel on the ground, both were poised to be record-breaking in severity and damage to property and resource values. However, fire crews and post-fire recovery teams have touted that strategically placed treatment areas provided critical fire breaks and helped fire crews prevent the megafire catastrophes that we have come to expect.

The Slide Fire, in particular, could have burned ten times as many acres as well as hundreds of homes in the greater Flagstaff area. What helped prevent that from happening was the foresight of the Greater Flagstaff Forests Partnership and the U.S. Forest Service managers of the Coconino National Forest, which in years prior to the fire, implemented restoration-based hazardous-fuel reduction treatments. Based on the long-standing research at the Ecological Restoration Institute of Northern Arizona University, these treatments included protecting the older trees, mechanically thinning small, young trees in areas around the community to remove unnaturally high densities of trees, and burning slash and ground litter to restore natural forest conditions—conditions that would not support catastrophic crown fires. The fact that there were treatments between Flagstaff area homes and the Slide Fire accomplished several things, perhaps the most important of which was that it enabled fire crews to safely conduct burnout operations and eliminated the threat of the devastating fire.

The San Juan Fire also provided lessons about how treated areas did what they were designed to do: slow a fire's advance and restore a forest's natural ability to self-regulate. How a wildfire behaves when it reaches a treatment area is a good test of how those treatments work and would work over large landscapes. Fire crews and incident management teams reported that when the fire burned into areas that had been restored, it burned with low severity and on the ground, not in treetops. The dry, frequent-fire forests of the West evolved with this type of fire, a slow-moving, low severity surface fire that would remove young trees and revitalize understory grasses and forbs. Evidence from the San Juan Fire also suggests that the previously treated areas allowed fire crews to safely conduct burnout operations, thus enabling them to manage and control the fire.

Landscape-scale forest restoration is vital to solving fire and forest health problems in the West

While the San Juan and Slide fires and other examples in the West provide evidence that restoration-based fuel management treatments work, they are also clear indications that we cannot afford to be complacent. Forest conditions throughout the West are dominated by drought conditions across very large areas. For example in Arizona alone, we still have 15 million to 20 million acres of forest, including ponderosa pine, pinyon juniper and mixed conifer—all primed to burn. It is not a matter of if they will burn, but when.

Meanwhile, on a regional scale, forest health treatments and community protection projects are just dots on the landscape. They are not enough to save forests on a large scale. Research shows that more needs to be done than simply reducing fuel loadings around the WUI, where forested lands meet urban homes. The results from work at the Ecological Restoration Institute and elsewhere indicate that without conducting broader, strategically located restoration and hazardous fuel reduction treatments outside of the WUI, landscape-scale fires will continue to occur with devastating impacts on watersheds, wildlife habitat, and other natural resource values. Such fires under severe conditions can lob firebrands into communities even though the fires themselves may be several miles away.

In the face of global climate change, the best hope for those of us in fire-prone dry forest landscapes is to have ecosystems restored to more natural and self-regulating conditions. Such systems are ready to cope with the changes likely to come our way. Just like in human medicine, a person has the best chance to fight off and recover from an illness when they are healthy. It is important to make sure our forests are in their most natural, healthy condition so they, too, are resilient to disturbances like fire, insects, disease, and climate change.

Unless concerted actions across large multijurisdictional landscapes are taken to reverse ongoing ecosystem degradation, the prospects look grim for the quality of life—not only for the forest and woodland ecosystems of the region, but also for the human populations that rely on them.

As forests across the West continue to burn hotter and longer than ever before, it is clear we don't have much time left. By acting quickly and at larger scales, we can restore forest health and build resiliency, protect homes, save lives, and provide jobs. Not only that, but doing so will help prepare forested landscapes for whatever changes may occur in the future.

The CHAIRMAN. Thank you, Dr. Covington.
Mr. Zerkel, welcome.

**STATEMENT OF RICHARD ZERKEL, PRESIDENT,
LYNDEN AIR CARGO, LLC**

Mr. ZERKEL. Madam Chairman, members of the Committee, thank you for this opportunity to discuss aerial firefighting policy with you today.

My name is Rick Zerkel, and I'm the President of Lynden Air Cargo, an all cargo operator of L382G aircraft based in Anchorage, Alaska.

Lynden's seven aircraft are the civilian version of the Lockheed C130 and are operated under Federal Aviation Administration Part 121 Air Carrier Regulations, the same requirements followed by all major U.S. airlines including Delta, American and United. This is the highest safety standard under FAA regulations.

The U.S. Forest Service is currently operating one C130H under public aircraft rules and plans to add more. This is in direct conflict with the findings of the 2002 Blue Ribbon panel report to the Forest Service titled, "Federal Aerial Firefighting: Assessing Safety and Effectiveness." And I'd like to read a couple of those findings real briefly.

Under Finding 3, Aircraft. Under the current system of aircraft certification, contracting and operation key elements of the aerial wildland firefighting fleet are unsustainable. The FAA has essentially said, "It's a public use aircraft. You're on your own."

Under Finding 6, Certification. The Federal Aviation Administration has abrogated any responsibility to ensure the continued airworthiness of public use aircraft including ex military aircraft converted to firefighting air tankers. Although these aircraft are awarded FAA type certificates, the associated certifications do not require testing and inspection to ensure the aircraft are air worthy to prepare for their intended missions. The panel found that the Forest Service and BLM leaders do not have a good understanding of the FAA certification and oversight rule regarding public use aircraft. Just like the Blue Ribbon panel, we are opposed to the U.S. Forest Service operating a government-owned airline under public aircraft format for the purpose of fighting wildfires when qualified civilian aircraft are available. Lynden spent substantial capital in one year complying with the regulatory, technical and physical conversion of one of our Hercules in order to lease to a qualified operator under the next generation 2.0 solicitation. A very tight timetable and rigid requirements resulted in our aircraft being rejected while the U.S. Forest Service operated the first of seven C130H aircraft equipped with an obsolete dispersion system and operated without FAA oversight. By necessity the Lynden aircraft was deployed to Australia where it is in service to the National Aerial Firefighting Center.

Our message this morning can be summarized in three main points.

First, the commercial aerial firefighting industry is entirely capable of providing all of the Forest Service large air tanker requirements at considerably less expense than the current planned use of the C130H aircraft.

Second, the acquisition and use of the C130H, in this depends on the structure of the program, may be in conflict with Federal acquisition regulations and the Economy Act.

Most importantly though, the non-regulated, public aircraft format proposed for the government-owned large air tanker fleet is inherently less safe than the rigorous standards a commercial fleet must adhere to and has set an unfair double standard. This double standard resulted in the most capable and safest firefighting aircraft being deployed elsewhere while an unregulated and expensive government aircraft fought fires in our country.

More importantly we believe that regulatory certification and safety standards mandated by the FAA been established for a sound reason, to mitigate the possibility of loss of life and property. These standards should be applied to all aircraft operating in the harsh environment of aerial firefighting without exception.

As we speak it appears the Forest Service intends to operate the C130Hs under the public aircraft category accepting responsibility for their continuing airworthiness and for certifying the design safety of the retardant tank installation. If the Coast Guard is retained as the engineering authority, the expertise of the FAA is completely removed from the process.

The Forest Service has been very specific that all commercial large air tankers be modified in accordance with the very demanding and time consuming FAA certification process. Now the industry accepts these parameters and the time and expense it involve, but we strongly disagree the Forest Service should waive this requirement for itself and opt for the less stringent public aircraft option. There should be one safety standard for all aircraft involved in aerial firefighting and it should be the most robust safety standards contained in the FAA regulations.

Lynden Air Cargo provides the following recommendations. Number one, commercial aircraft operators, including Lynden and others, are available and ready to meet aerial firefighting requirements of the Forest Service. We urge the Committee to provide direction to the Forest Service to utilize available and qualified aircraft prior to employing any government-owned aircraft. The U.S. Forest Service should be required to certify any aircraft they do operate, certify and maintain the aircraft and dispersant systems to the same rigorous standards as industry. And Number three, no funds should be authorized or appropriated to the Forest Service to acquire or upgrade additional aircraft until private industry has had an opportunity to respond to a final round of the next generation solicitation. As long as commercial operatives can meet the Forest Service requirements the Forest Service should refrain from competing.

Madam Chairman and members of the Committee, I welcome your questions.

[The prepared statement of Mr. Zerkel follows:]

Richard Zerkel
President
Lynden Air Cargo, LLC

**Testimony before the U.S. Senate Committee on Energy and Natural Resources
Hearing to Review Past Wildfire Seasons to Inform and Improve Future Federal
Wildland Fire Management Strategies
November 17, 2015**

Madam Chairman, members of the committee. Thank you for this opportunity to discuss Aerial firefighting policy with you today.

My name is Rick Zerkel. I am the president of Lynden Air Cargo, an all-cargo operator of L 382G Hercules aircraft, based in Anchorage, Alaska.

Lynden's seven aircraft are the civilian version of the Lockheed C-130 and are operated under Federal Aviation Administration Part 121 Air Carrier regulations, the same requirements followed by all major US airlines; including Delta, American and United. This is the highest safety standard under FAA regulations.

The USFS is currently operating one C-130H under Public Aircraft rules and plans to add more. This is in direct conflict with the findings of the 2002 Blue Ribbon Panel Report to the USFS titled **Federal Aerial Firefighting: Assessing Safety and Effectiveness -**

FINDING 3--AIRCRAFT

Under the current system of aircraft certification, contracting, and operation, key elements of the aerial wildland firefighting fleet are unsustainable.

- FAA has essentially said, "It's a public-use aircraft. You're on your own."

FINDING 6--CERTIFICATION

The Federal Aviation Administration (FAA) has abrogated any responsibility to ensure the continued airworthiness of "public-use" aircraft, including ex-military aircraft converted to firefighting air tankers. Although these aircraft are awarded FAA type certificates, the associated certification processes do not require testing and inspection to ensure that the aircraft are airworthy to perform their intended missions.

- The panel found that Forest Service and BLM leaders do not have a good understanding of the FAA's certification and oversight role regarding public-use aircraft.

Just like the Blue Ribbon Panel, we are opposed to the USFS operating a Government owned airline, under the Public Aircraft format, for the purpose of fighting wild fires when qualified civilian aircraft are available.

Lynden spent substantial capital and one year complying with the regulatory, technical and the physical conversion of one of our Hercules in order to lease to a qualified operator under the Next Generation 2.0 solicitation. A very tight timetable and rigid requirements resulted in our aircraft being rejected while the USFS operated the first of seven C-130H aircraft, equipped with the obsolete MAFFS II dispersant system and operated without appropriate FAA oversight. By necessity, the Lynden aircraft was deployed to Australia where it is in service to the National Aerial Firefighting Centre (NAFC).

Our message this morning can be summarized in three main points:

- First, the commercial aerial firefighting industry is entirely capable of providing all of the Forest Service's Large Air Tanker requirements at considerably less expense than the current planned use of C-130H aircraft.
- The acquisition and use of the C-130H aircraft may be in conflict with the Federal Acquisition Regulations and the Economy Act.
- And most importantly, the non-regulated, public aircraft format, proposed for the government owned large air tanker fleet is inherently less safe than the rigorous standards the commercial fleet must adhere to and has set an unfair double standard. This double standard resulted in the most capable and safest firefighting aircraft in the world being deployed elsewhere, while an unregulated, unqualified and expensive Government aircraft fought fires in our country.

More importantly, we believe the regulatory, certification and safety standards mandated by the FAA have been established for a sound reason; to mitigate the possibility of loss of life and property. These standards should be applied to all aircraft operating in the harsh environment of aerial firefighting without exception. As we speak, it appears the Forest Service intends to operate the C-130H's under the public aircraft category, accepting responsibility for their continuing airworthiness and for certifying the design safety of the retardant tank installation. If the Coast Guard is retained as the engineering authority the expertise of the FAA is completely removed from the process.

The USFS has been very specific that all commercial Large Air Tankers be modified in accordance with the very demanding and time consuming FAA certification process. The industry accepts these parameters and the time and expense involved, but we strongly disagree that the Forest Service should waive this requirement for itself and opt for the less stringent public aircraft option. There should be one standard for all aircraft

involved in aerial firefighting and it should be the robust safety standards contained in FAA regulations.

We also contend that private enterprise is more experienced and efficient at meeting the demanding requirements including certification and operation of Large Air tanker aircraft. By default, this enables them to be more cost effective than Government managed operations. Congress realized this long ago and codified the idea that government should not compete with industry not only as a matter of policy but equally important, as a matter of efficiency.

Lynden Air Cargo provides the following recommendations:

1. Commercial aircraft operators, including Lynden and others, are available and ready to meet the aerial firefighting requirements of the USFS. We urge that this committee provide direction to the USFS to utilize available and qualified aircraft prior to employing any Government owned aircraft.
2. The USFS should be required to certify and maintain the aircraft and dispersant systems to the same rigorous standards as industry.
3. No funds should be authorized or appropriated for the Forest Service to acquire or upgrade additional aircraft until private industry has had an opportunity to respond to a final round of the Next Generation solicitation. As long as commercial operators can meet the Forest Service's requirements, the USFS should refrain from competing.

Madame Chairman and members of the Committee I would welcome your questions.

The CHAIRMAN. Thank you, Mr. Zerkel.
Mr. Burnett, welcome.

**STATEMENT OF MIKE BURNETT, FIRE CHIEF,
CHELAN COUNTY FIRE DISTRICT 1**

Mr. BURNETT. Thank you very much, Madam Chair and Senators. Thank you for the opportunity to offer this testimony to the Committee.

My perspective comes from that of a Fire Chief in North Central Washington as well as an incident management team member as a planning section chief, one of the type one teams that are put together on a national basis.

The fire season for us in our county started in late June with the Sleepy Hollow fire in Wenatchee. We had 30 homes that were lost and three warehouses. Followed by the next tragic fire which was the Reach fire in Lake Chelan. The Reach fire combined with the other fires in the area became part of the Chelan Complex that grew to almost 90,000 acres and destroyed 51 homes and an additional three warehouses. Five days later we had the tragic loss of three firefighters outside of Twist, all that's happened in North Central Washington.

The 2015 fire season was also my busiest year as an incident management team member. Our team was deployed to four different fires, the Newby Lake fire which came out of Canada into Northern Washington, the National Creek Complex fire in Crater Lake National Park and then North Central Washington again for the North Star fire and the Tunk Block fire.

Efforts are being made to address the growing costs and severities of wildfires. On a regional level the Okanogan/Wenatchee National Forest, BLM, the Washington Department of Natural Resources and all of the local fire districts have worked together to ensure that we work more collaboratively when a fire occurs.

Recently our community hosted a one day summit titled, "The Wildfire and Us." The goal of the summit was to develop a regional approach to reduce the risk of wildfires. Attended by approximately 500 residents it was a great success and illustrated the interest that people in our region have on the subject.

Locally Chelan County Fire District 1 has established a connection with the Forest Ridge Wildfire Coalition. Our department has partnered with the Forest Ridge Coalition to assist them with grant funding for fuel reduction projects, participates with their Fire Wise community outreach and has initiated an alert system to notify their board members who in turn activate their phone tree.

From a local perspective if we're to improve our ability to respond to wildfires, I believe that we need to address four issues: increase our efforts on education and prevention, support quicker initial attack, continue fuel reduction efforts, and allow for earlier utilization of air resources.

Education and prevention needs to occur on a local level. Our firefighters are part of our community and they're trusted, respected and capable of providing the education to the public. The problem is most rural fire districts have limited staffing due to funding. The Sleepy Hollow fire that I referenced earlier had ap-

proximately 150 firefighters assigned to it, of which 120 of them were volunteers.

Any Federal funding to support a wildfire education and prevention program would pay substantial dividends. Training local firefighters to perform home assessments, cost shares on hardening homes, conducting evacuation preparedness drills and education on the value of beneficial fires are all examples of a good prevention program. The value of a prepared community translates directly to a safer environment for firefighters.

Next we need to augment the initial attack capabilities of local resources. I measure initial attack response times in minutes and catching a wildfire in hours. Local jurisdictions need resources available to them and much quicker than what wildland agencies are currently able to provide. We have—we need funding for the seasonal firefighters to be available on a local level so that the initial attack can be more robust and more rapid. These seasonal hires could also be used to enhance the community's outreach with a focus on building a more fire adapted community.

We need to continue the fuel modification efforts. The treatment area near the Beehive Reservoir just outside of Wenatchee is a great example of how it can reduce the impacts of wildfire. The Peavine fire in 2012 burned through the area, stayed on the ground as a surface fire and was stopped on a Forest Service road system.

And last, the use of aviation resources early on can keep a small fire from becoming another expensive, large fire. Unfortunately as an incident commander from a local fire district I have to rely on the Forest Service or a state duty officer to arrive on the scene, make a determination if the fire is in their jurisdiction or a threat to their jurisdiction before a helicopter can be ordered. Most fire districts cannot afford the cost of air attack resources. If the State and Federal Government want the fire extinguished when they are small and manageable, we need the resources to do the job. Give the local fire chief the authority to call for them when they're needed and have the State or Federal Government pay for it so that the local fire district is not financially devastated.

I provided my perception of the complex issue. By no means do I feel that the system is broken; however, there are opportunities to improve our efforts via the funding for rural fire departments, enhancing education and prevention strategies and continuing fuel reduction efforts.

In closing I want to thank the Committee again for hearing my testimony and I appreciate the opportunity to provide a voice in this important discussion.

[The prepared statement of Mr. Burnett follows:]



P.O. Box 2106
206 Easy Street
Wenatchee, WA 98807
(509) 662-4734
FAX (509) 662-3967

November 13, 2015

To: U.S. Senate Committee on Energy and Natural Resources
From: Fire Chief Mike Burnett, Chelan County Fire District 1

Chairman Murkowski, Ranking Member Cantwell, and Committee Senators,

Thank you for the opportunity to offer testimony to the Senate Committee on Energy and Natural Resources. It is an honor to represent the perspective of local fire chiefs in this extremely important discussion. In order to improve future wildland fire management strategies, the choices we make as individuals and at all levels of government need to be modified. It has been noted by experts in the field that fires are becoming more frequent with increased size and intensity. To address this fact we need to:

- Allow natural fire on the landscape where it is not a threat to people and homes.
- Increase education and prevention.
 - Enact codes and building standards for construction in the Wildland Urban Interface (WUI).
 - Create incentives for homeowners to "fire harden" their homes.
 - Allocate funds and resources to increase education and prevention efforts.
- Allow, and fund, prescribed fires and fuel reduction efforts.
- Aggressively fight the fires when they first start in order to keep them smaller and less expensive.
- Better utilization of air resources.
- Reprioritization of federal grants.

The recommended solutions from subject matter experts will vary based on the individual's perception of the problem; facts are facts, but perception is reality. My desire today is to inform you of my perception, and hopefully add to the discussion, in order to frame a more common reality.

I am a fire chief in North Central Washington, which is home to Leavenworth, Chelan, Pateros, Brewster, and Wenatchee. Our area lost over 400 homes to wildfire in the last two fire seasons. Even more devastating is the loss of three firefighters who died this year trying to escape a fast moving fire outside of the town of Twisp. Chelan County Fire District 1 (CCFD1) is a combination fire department, which means we staff our stations with a combination of both career and volunteer firefighters. CCFD1 encompasses the largest town in the area, the City of Wenatchee, and our entire jurisdictional boundary is truly WUI country. Our annual budget is approximately \$6 million, which is more than twice any other fire district in the area. In the two neighboring counties, there are only 48 career firefighters. Of those firefighters, 11 are typically on duty at any given time with seven of them from CCFD1. We, like many fire departments across the country, rely heavily on the support of volunteers to aid in the protection of our communities.

I am also fortunate enough to participate on one of the 16 National Type 1 Incident Management Teams (IMT) as the Planning Section Chief. These teams are geographically located throughout the country and are deployed to incidents of national significance with the highest level of complexity. This experience has allowed me to aid other communities in their battles against wildfires and has given me a better understanding of the values, complexities, and restraints of fighting wildfires where multiple agencies and

jurisdictions are involved. On the less positive side, there are frequently competing interests, differing policies, and cost allocation issues. On the positive side, sharing of resources, combining of expertise, funding of aircraft, and development of common objectives are all extremely valuable to citizens.

Every year, North Central Washington experiences a very active fire season. The intensity and duration of our fires has been increasing over the last few years. In 2014, the Carlton Complex alone burned over 250,000 acres and destroyed over 300 homes. In 2015, over 900,000 acres burned with the largest fires being:

- Chelan Complex – 88,985 acres
- Carpenter Road – 63,972 acres
- Okanogan Complex – 133,450 acres
- North Star – 218,138 acres
- Tunk Block Fire – 165,918 acres
- Wolverine – 65,512 acres
- Kettle Complex – 73,392 acres

Thousands of firefighters were deployed and hundreds of millions of dollars spent, yet we still lost hundreds of structures and most importantly, we lost the lives of three young men.

This past fire season started for us in June following multiple days of 100+ degree temperatures. On June 28th at 2:16 in the afternoon, a small human-caused fire was reported at the base of a hill. The fire was very visible from the nearby highway and our 911 center received multiple reports of the fire. The fire, named the Sleepy Hollow Fire, ultimately grew to 2,950 acres. The initial response came from local fire districts; all volunteer resources with one engine staffed with career firefighters. The initial attack incident commander (IC) requested additional local resources and notified our State and Federal partners: Department of Natural Resources (DNR) and the Okanogan/Wenatchee National Forest (FS). By 4:00pm, the IC had called for a second alarm response, followed by a third alarm, which dispatches all of the predetermined resources in our region. He also had the Duty Officers from DNR and the FS on site assisting with coordinating efforts. Throughout the afternoon, firefighters worked in triple digit temperatures and were successful in protecting over 50 primary residences directly threatened by the fire in the Sleepy Hollow neighborhood. The fire travelled a little more than a mile in five hours, at which time we experienced an increase in wind and fire behavior. This caused the fire to travel an additional mile in about one hour. Unfortunately, at the end of that mile was a housing development built on top of a steep ravine, which was loaded with old-growth sagebrush. This resulted in the destruction of 30 homes. The fire also spotted more than a mile away into a commercial warehouse district. The spot-fire took hold on a roof of a chemical warehouse and then spread to the roofs of two additional fruit packing warehouses. Late into the evening, every available engine was assigned to the incident. For several hours, the only fire protection left for our area was a Crash Rescue truck from the airport. The estimated direct economic loss was over \$110 million dollars. Indirect, long-term losses to the community have yet to be determined.

Chelan County's next tragic event occurred on August 14 just outside of the town of Lake Chelan. A lightning-caused fire was reported on the hill behind the town. Shortly thereafter, several additional fires were reported in the area. These fires eventually became the Chelan Complex, which covered 88,985 acres. Within hours of the first report of the fire, homes were being lost. Over the next 24 hours, 51 structures and 3 fruit packing warehouses were destroyed by fire.

Both of the fires described above, and the vast majority of fires in our region, are similar in nature;

- The destroyed homes are inside of a fire protection district, or city, which is surrounded by State or Federal ground.

- The fires start near an interface area and quickly threaten structures.
- The fire departments lack the funding to pay for air resources and the early use of air resources may have made a difference.
- There are firefighters on scene in a short period of time but the fires quickly overrun the capacity of a rural volunteer, or combination, fire department.
- State and Federal resources engage, but due to their primary responsibilities as wildland firefighters, they are slower to react to urban interface fires, limited on initial attack capabilities, and are not as suited for structure protection.
- Most of the homes are in vulnerable locations and are not fire hardened through building materials, design, or landscape modifications.

Beside the Sleepy Hollow Fire, and multiple smaller fires within our fire district, I was deployed with our IMT to the Newby Lake Fire, which was the fire that started in Canada and grew into northern Washington. Later the IMT was deployed on a 30-day assignment, first to the National Creek Complex in the Crater Lake National Park followed by a reassignment to the North Star Fire and the Tunk Block Fire in North Central Washington. In all cases, the basic objectives were the same; protect life and property, minimize acres burned, utilize cost containment best practices, enhance relationships with the community and stakeholders, and at all times base actions on a deliberate risk assessment.

There has been a continuous effort to improve fighting wildfires in our region. We have improved the working relationship between all government agencies. Our local fire districts have a standardized Cooperators Agreement with the Okanogan/Wenatchee National Forest. Radio frequencies are standardized to improve our communication capabilities. Wildland certifications are reviewed and approved by a multijurisdictional panel with representation from DNR, FS, BLM, and local fire districts. Annual training is conducted for all agencies utilizing a mixed cadre from all disciplines. We hold bi-monthly meetings for all North Central Washington fire agencies including BLM, FS, and DNR. Yet, even with these practices in place, changing environmental conditions and increasing fire behavior make it imperative that we work collaboratively with partners and increase our community-wide efforts.

There is a growing awareness that our community needs to do more to educate and inform residents on how to live with wildfires. Chelan County has two established wildfire coalitions, Forest Ridge outside of Wenatchee and the Chumstick outside of Leavenworth. Recently, active community members came together to put on the "Wildfire and Us Summit" in Wenatchee. The summit was dedicated to exploring what can be done by everyone involved: landowners, cities and counties, and state and federal agencies. The goal was to develop a comprehensive, cooperative, and collaborative regional approach to reduce the risks of wildfire loss. The event was free to the public and an estimated 500 people attended. With the increase of severe wildfires, a conscious education effort like this Summit, and programs like Firewise, more neighborhoods are asking what they can do to make their area a Fire Adapted Community.

Partnerships between the fire districts and their communities are improving. Forest Ridge Wildfire Coalition (FRWC) and CCFD1 have worked together to obtain grant funding for fuel reduction projects. DNR has provided cost share grants for chipping projects. CCFD1 attends the FRWC board meetings and participates in their Firewise Community efforts. A direct alert system to their board members has been established to facilitate rapid information transfer and evacuation. This system has been utilized several times for fire information and evacuation notices.

From my perspective, there is still work to be done and areas that need to be strengthened. I believe in order to improve our ability to respond to the negative impacts of wildfire we need to address these issues:

- Increased education and prevention.
- Continued fuel reduction.
- Quicker initial attack.
- Better utilization of air resources.
- Reprioritization of federal grants.

In order to change the public's perception of wildfire and their involvement in the problem, we will need to increase our education and prevention efforts. Utilizing the "3-E's", Educate, Engineer, and Enforce, over time we can change behavior and attitudes; seatbelts are an excellent example. The construction industry has already engineered building materials and improved construction methods to make the home more fire resilient. We also have the WUI Codes from the International Code Council. Communities need to adopt those codes and enforce those standards (the City of Wenatchee adopted them in 2011).

Homeowners make a conscious decision to build in the WUI and therefore need to take appropriate action to make their home more fire resilient. It is also our responsibility to educate that same homeowner on concepts such as: not all fire is bad, there will be times in the spring when we put smoke in the air through prescribed burns, we will not risk lives to save your home, and there are resources available to you to help make your home more defensible.

Our firefighters are part of our community. They are trusted, respected, and capable of providing the education to the public. The problem is most rural fire districts have limited staffing due to funding. The Sleepy Hollow Fire referenced earlier had approximately 150 firefighters assigned to the fire, of which 120 of them were volunteers. With very few career personnel available, the workload is focused on emergency response as opposed to proactive prevention. Any targeted federal funding to support a wildfire education and prevention program would pay substantial dividends. Training local firefighters to perform home assessments, cost shares on hardening homes (i.e. - changing out shake roofs), conducting evacuation preparedness drills, and education on the value of beneficial fires, are all examples of a good prevention program. The value of a prepared community translates directly to a safer environment for firefighters!

We need to continue fuel modification efforts. A portion of this effort involves correcting perceptions that fuel modification is a "scam" by the government to harvest more trees or that government employees are not able to perform the operation safely. Fuel modification in the form of prescribed burns or shaded fuel breaks have proven to be effective in reducing the spread of wildfire. A treated area does not stop the fire but it can give us a chance to catch the fire. For example: over the last decade, the FS performed fuel treatments followed by prescribed burns around the Beehive Reservoir area just outside of Wenatchee. During the 2012 Wenatchee Complex there were over 60 fires burning. One of the larger fires was the Peavine Fire at over 19,000 acres. Fire personnel utilized this treatment area to safely control the perimeter of the fire heading towards the Forest Ridge subdivision less than two miles away.

The initial attack is the best opportunity to catch a fire; statically most fires are caught on initial attack. From the perspective of a local fire chief, our initial attack response time is measured in minutes, and catching wildfires is measured in hours. The perspective of a wildland agency is different. The initial attack response time is measured in hours, and a fire being caught is measured in days. Local jurisdictions need resources available to them much quicker than the wildland agencies are currently able to provide. If a local fire district is involved in a wildland fire there will be a WUI component, and the option to not suppress the fire will not exist. We need more funding for seasonal firefighters to be available on a local level so the initial attack can be more robust and more rapid. We also need additional support from FEMA's Staffing for Adequate Fire and Emergency Response (SAFER) Grants. The SAFER program

should be expanded to assist fire prone communities with seasonal hiring. These seasonal hires could also be used to enhance the community outreach with a focus on building a more fire adapted community.

The utilization of air resources is controversial and expensive. The homeowner believes a retardant drop alone will put out the fire and the fire chief knows the cost of retardant would cripple their budget. Frequently, a wildland fire is inaccessible to conventional fire department apparatus. The use of aviation resources early on could keep a small fire from becoming another expensive large fire. Currently an IC from a local fire district must rely on a FS or DNR Duty Officer to arrive on the incident and make a determination on the appropriateness of the use of helicopters or air tankers. As a rule of thumb, "the agency that calls for it, pays for it" so the Duty Officer needs to determine if the fire is either in their jurisdiction or is a threat to their jurisdiction.

Here is an example: A five to ten acre brush fire across the Columbia River, with poor access, took 45 minutes for the first fire apparatus to arrive. DNR was notified and a helicopter was requested. The fire was outside of DNR's jurisdiction and they couldn't/wouldn't authorize the expense. A helicopter operating for 10 hours in support of the ground firefighter would have cost, on the high side \$30,000 (10 hours x \$3,000 an hour). Instead, the local fire department went through all their resources, all the available neighboring resources and then requested State Mobilization. The mobilization was authorized and the fire ended up costing the state around \$175,000, when it could have been handled for around \$30,000. Like the Sleepy Hollow Fire, which took almost two hours to get the first helicopter on it, this fire started out small. Local fire districts in North Central Washington cannot afford one bill for \$30,000 let alone the cost of an entire fire season. If the State and Federal government want the fires extinguished when they are small and manageable, we need the resources to do the job. Provide funding for early helicopter (initial attack) use with state or federal funds. Give the local fire chiefs/IC's the authority to call for them when they are needed. Have the State or Federal government pay for it so the local fire district is not financially devastated from the cost. This process will save money by keeping the fires smaller and more manageable.

Local fire departments have two major federal grants available to them, FEMA's SAFER grant, which was addressed above, and the Assistance to Firefighters Grant (AFG). The majority of the FEMA Grant awards go to larger organizations which are much better funded, better staffed, and have strong neighboring departments to help them out during major emergencies. That is not the case in most of the communities where homes are being lost to wildfires. Many rural fire departments rely on used military equipment for their wildland apparatus. There should be a better method of prioritizing grant funds to rural departments.

I have provided my perception of a complex issue. By no means do I feel the system is broken. There are many good efforts being performed with a common goal of reducing the risks from wildfires. However there are opportunities to improve our efforts via funding for rural fire departments, enhancing education and prevention strategies, and continued fuel reduction efforts. Our citizens recognize the need, and have the expectation, for us to address how we can improve our response to wildland fires. The problems we face are becoming more complex reinforcing the need for action.

In closing, I want to thank the Committee again for hearing my testimony and I appreciate the opportunity to provide a voice in this important discussion on how to improve future federal wildland fire management strategies.

Sincerely,

Mike Burnett, Fire Chief

The CHAIRMAN. Thank you, Chief.
Mr. Wyss, welcome.

**STATEMENT OF JON WYSS, CHAIRMAN, OKANOGAN COUNTY
LONG TERM RECOVERY GROUP**

Mr. WYSS. Senator Murkowski, Senator Cantwell and members of the Committee, thank you for holding this hearing today.

I was born in Thermopolis, Wyoming, son of a seventh and eighth grade science teacher and raised in Worland, Wyoming just east of Yellowstone National Park. Growing up in Wyoming allowed me to have great respect for our natural environment, natural resources, natural parks and people. It also allowed me to see my first wildfire disaster in 1988 when Yellowstone was set ablaze by a lightning strike. Who knew 27 years later I'd be in the middle of back-to-back wildfires in Eastern Washington which have destroyed over 500 structures in a community with less than one percent vacancy rate.

After graduating high school I attended college in Texas, and I worked for the U.S. Bankruptcy Trustee offices in four separate states, then served as a Chief Deputy Assessor in Spokane County and even served three days as a state senator when Senator Benson was on military leave. I now work for my wife's family company, Gebbers Farms, who provided suppression resources in 2014 and in 2015. We also lost 7,000 acres of our private timberlands that abut the Forest Service and DNR.

My upbringing and background and Chair as the Long Term Recovery Group give me a perspective at looking how these fires disrupted our communities. The 2015 Washington wildfires consumed one million acres and consisted of eight fires. The fire storms called multiple level 3 evacuations including my own home. When it came time to evacuate not all the memories could be packed up, not all the animals could fit in one trailer and so gates swung open, fences were cut and animals were left to fend for themselves.

When people could return some came back to their homes standing. Others lost everything including their animals, only to be known by the bangs tag in the dead animal's ear. Then as the fires raged on and the winds picked up we heard over the radio a call that no firefighter ever wants to hear. We have seven firefighters trapped.

On that fateful day the bell rang for the last time for three brave souls, excuse me, as they tried to escape. We pay our respects to the victims and their families where they sacrificed everything.

At the time Washington State's FEMA application, an estimated \$123 million in suppression costs were expended. We question if some of these costs could have been avoided with better real time weather information. The National Weather Service Doppler radar network has a gap in coverage in our state where we can't see below 10,000 feet in Chelan, Douglas or Okanogan Counties where most of these fires occurred.

In Washington State the U.S. Forest Service has four times more land than that owned by the state. Over the last 27 years we've seen a change in forest management practices and a decline in timber harvest in our state. By not allowing fires to burn as they historically have or thinning out all the trees that have resulting

growing up we've increased the fuel load and lowered the timber value and increased chances for massive wildfire.

After back-to-back fires many are saying log it, graze it or watch it burn. But we do not want to promote unabated logging and landscape alterations. Common ground can be found on these issues.

A local rancher and forester told me, "We must remember, fire is good for the environment when it can burn along the ground in a controlled manner. Fire is not good when it races through untreated corridors of riparian area that have been untouched for 30 years leading to bad fire. These conditions can be changed with proper management that isn't paralyzed by incessant threats and appeals. It's not a zero sum game where these disasters have to happen before we hit the reset button."

What lessons can and have we learned from the fires?

Lesson one. It starts here, right here today is what decides it all. The Committee hearing and the comments from those testifying will be decided where we go in the future. It starts right here with you, the elected officials who can pass legislation and have oversight so this doesn't happen again. It starts from the agencies wanting to make sure the changes that are needed are being bold in their choices to ensure this doesn't happen again.

For example, on this summer's fire near me a state contracted CAT was being used to build a fire suppression line through state and private lands. When the CAT and driver hit the Forest Service grounds the CAT was stopped, stopping suppression activities because the CAT didn't have a Federal certification.

Lesson two. For the first time in decades Washington put out a call for volunteers to come help fight fires, but we didn't have enough fire-trained bosses to lead those volunteers.

Lesson three. The land is precious. What we can all agree is the land is precious. We've learned over the years that it's expensive to manage lands, but even more so to repair them devastated by fire.

It's time we end fire borrowing and put the money back into the proper management of lands to make our lands healthier, our forests healthier and our national, our natural resource economy vibrant in our local and tribal communities.

What are the cascading impacts of wildfire in our communities? As you heard 20 percent of the managed timber lands of the Colville Reservation burned with up to \$1 billion in value. The Spokane Tribes estimated in the Carpenter Road fire they lost \$1 million of timber. Citizens of this great nation are owners of the land. It ought to mean something.

After the Carlton Complex fire the State House passed Representative Joel Kretz's bill, House Bill 2093, unanimously. Passage of this bill was important as on August 14th the lightning strike struck in the Carlton Complex donut hole, as we call it. The Paradise fire was threatening 22,000 acres of which half was Forest Service ground.

Gebbers Farm mobilized the necessary equipment to surround the fire, contain it from spreading, utilizing the new law. What could have been a 22,000 acre fire was 2.7 acres and out immediately.

I would be remiss if I didn't thank the Forest Service, USDA, Department of Interior, FEMA and a host of other Federal agencies who have worked closely with our long term recovery group to assist our community in recovery efforts.

Last, Senator Cantwell, we appreciate that you held the meeting in Wenatchee and then co-hosted a meeting in Spokane with Representative Morris Rogers. The meetings with various fire chiefs, industry leaders and elected officials kept this issue in the forefront and has led to ideas gathered that will lead to change.

Right here today we can make a difference, and right now it's up to us.

Thank you for your time.

[The prepared statement of Mr. Wyss follows:]

JON WYSS
CHAIRMAN OKANOGAN COUNTY LONG TERM RECOVERY GROUP

WRITTEN TESTIMONY SENATE ENERGY AND NATURAL RESOUCES COMMITTEE

TUESDAY NOVEMBER 17, 2015 10:00 AM
ROOM 366 DIRKSEN SENATE OFFICE BUILDING

Senator Murkowski, Senator Cantwell and members of the Committee, my testimony to you today is as Chairman of the Okanogan County Long Term Recovery Group, formerly known as the Carlton Complex Long Term Recovery Group. Chairing this organization has been one of the most challenging, and yet most rewarding things I have ever done. I am grateful for the opportunity to lead this fine organization and thankful you have given us the opportunity to testify today.

I was born in Thermopolis WY and raised in Worland, WY just east of Yellowstone National Park and near the beautiful Big Horn Mountains. Growing up in Wyoming allowed me to have great respect for our natural environment, our national forests, our national parks, and a great respect for people and their private property rights.

It also allowed me to see my first Wildfire Disaster in 1988 when Yellowstone National Park was set ablaze by a lightning strike. I remember school being canceled because of air quality issues, one of my best friends who had asthma was forced to stay inside and wear a mask to ensure he could breathe, and having to shovel ash off the car as if it were snow in the middle of winter. Who knew 27 years later I would be right in the middle of Washington States largest back-to-back wildfires in history and reliving these same issues.

After graduating high school, I attended college in Texas. I worked for a variety US Bankruptcy Trustee Offices in four states over 11 years. I then served as the Chief Deputy Assessor for Spokane County and even served 3 days as a Washington State Senator when Senator Brad Benson was on military leave.

I now work for my wife's family company, Gebbers Farms, which consists of apples, cherries, cattle, and timber that were all impacted by the 2014 and 2015 fires. These fires burned over 5,000 acres of our timberlands. Our company also provided fire suppression resources during both fires.

My childhood upbringing and my employment background give me a unique perspective when looking at all of the environmental, financial and legislative impacts of the fires that have disrupted our communities.

The 2015 Washington Wildfire Season consumed over 1 million acres and consisted of 8 major fires and multiple smaller fires. The fires threatened homes, cabins, hotels, agricultural grazing lands (both government owned and private), small businesses,

critical infrastructure and lives. In all, the 2015 fires in Washington State impacted 13 counties and four different Tribal Reservations.

The Okanogan, Tunk Block and North Star Complex wildfires burned the largest amount of acreage in state history at 522,920 surpassing the previous record set in the 2014 Carlton Complex Fire that burned 256,108 acres. The below chart gives additional information of acreages burned by area as of 9-18-2015:

9 MILE	4,712 ac	2-SFR	0-Cabins	3-Misc Buildings
Chelan Complex-Okanogan	35,036 ac	7-SFR	0-Cabins	12-Misc Buildings
Newby Lake	5,150 ac			
North Star	157,437 ac			
Okanogan Complex	133,130 ac	32-SFR	40-Cabins	35-Misc Buildings
Tunk Block	162,992 ac	36-SFR	46-Cabins	50-Misc Buildings
Twisp Fire	11,119 ac	7-SFR	3-Cabins	7-Misc Buildings
Wild Horse	163 ac			
Total Okanogan County 509,739 ac		**SFR - Single Family Residence Destroyed		
Chelan Complex-Chelan	26,237 ac			
Chelan Complex-Douglas	27,752 ac			
North Star-Ferry County	60,593 ac			
Total 114,582 ac				
Total Combined Fire 624,321 ac				

To put these fires in perspective the Carlton Complex Fire is four times the size of Seattle and the Okanogan Complex Fires would encompass Rhode Island. When you add in the Sleepy Hollow Fire near Wenatchee, WA and the Chelan Complex fires, the fire perimeter would be 1,261 miles which is from Washington DC to Denver, CO.

The communities within Okanogan County and the Confederated Tribes of the Colville Reservation were struggling to recover from the physical, emotional, and economic damages of the 2014 Carlton Complex fires when the 2015 fires erupted. The Okanogan Complex fires caused level three immediate evacuations of more than 1900 residents, a near repeat of the 2014 Carlton Complex Fires.

Chelan County had immediate level 3 evacuations for an additional 2900 residents, including residents in Douglas County. My own home was placed on a level 2-evacuation notice.

At one point all of Stevens County was placed on a level one evacuation because power outages, emergency alert outages, and lack of fire protection assets to carry out evacuations. While at the same time the cell towers went down, power went out, and internet lost within the Colville Reservation causing significant communication challenges.

Our local police, county sheriffs, other law enforcement personnel, and emergency management agencies in conjunction with our local firefighters did everything they could to notify people to leave as these massive fires exploded in each of the counties.

Our community members, many of them ranchers, packed, taking only what they could fit in their vehicles. While the children loaded the cars and trucks, the parents were doing everything they could to load up livestock, horses and animals to get them away from harms way. When it came time to leave not all the memories were packed up and the animals could not all fit into one trailer, the families swung gates open and cut fences to let the animals out to fend for themselves. The families then gathered together to say a prayer that their animals and homes would be protected and drove away.

When they could return, some came back to homes standing and animals still alive, while others lost their homes, all their belongings, and some of the animals could not outrun the fires and perished only to be known by the bangs tag number in the ear of the cow.

Then, as the fires raged on and the winds picked up, we heard over the radio a call that no one fighting wildfires ever wants to hear, "we have 7 firefighters entrapped on the Twisp River Fire". On that fateful day August 19, the fire bell rang for the last time for three brave soles as they tried to escape the fires. We pay our respects to the victims and their families as they sacrificed everything to keep our communities safe.

The 2014 fires destroyed 353 homes and caused an estimated \$98 million dollars in damages. Then Mother Nature had one more punch for those that experienced the Carlton Complex Fires. On August 21, 2014, a rainstorm dropped one inch of rain on the land reduced to ash and bare soil causing a flash flood and massive mudslides that washed out small irrigation dams, houses off foundations, vehicles into creeks, and caused sections of the highway to wash away under 5 feet of mud that was 145' wide--causing additional economic damage. We now wait, in each of the impacted counties and tribal reservations, for the impending mudslides and floods that could come as a result of the 2015 fires when the rains start and the snow pack melts.

The 2015 fires burned 107 miscellaneous buildings, 89 Cabins, and 114 homes. Housing in the burn areas has become critical because of the loss of over 460 homes in an area: there was already less than a 1% vacancy rate before Carlton Complex destroyed the hundreds of houses in 2014.

In total at the time of Washington State's FEMA Application, 29 fire mobilizations costing an estimated \$28,845,000 in fire suppression costs were expended on local lands. Additionally the state incurred an estimated \$94,872,860 in fire suppression costs on state lands. Could some of these costs been avoided if we had better real time weather information?

As you may or may not be aware, similar to portions of western Washington before 2011, the National Weather Service (NWS) Doppler radar network has a gap or hole in coverage along the eastern slopes of the Cascades to the Canadian Border and down to the Columbia Basin outside of Yakima (Exhibit A).

There are five (5) active Doppler radars that monitor real-time weather conditions for the state of Washington (Spokane, Pendleton, Langley Hill (Grays Harbor), Camano Island (Seattle), and Portland) that are utilized by the NWS to monitor hazardous weather conditions and predict weather. None of the five radars have coverage of weather conditions on lands below 10,000 feet in the north eastern slopes of the Cascades from the Canadian Border and down to the Columbia Basin outside of Yakima.

This season's wildfires will leave many areas prone to severe debris flows, including areas that are heavily populated with substantial public and private infrastructure. Better, more accurate information will help agencies and private property owners prepare and respond to these events, potentially reducing the impacts and costs associated with clean up.

In Washington State, the US Forest Service has over four times more land than that owned by the State of Washington. Over the last 27 years we have seen a change in forest management practices and a decline in timber harvest on Federal Lands. The Washington State DNR has harvested 30 times more volume than the USFS and has been 1283 times more profitable (Exhibit B).

By not allowing fires to burn as they historically have or thinning out all the trees that have resultingly grown up, we have increased the fuel load, lowered the timber value, and increased the chance for massive wildfires. The current practice of fire borrowing has also led to a significant amount of challenges to managing the forest. Rather than performing the necessary treatments to keep fires smaller and more manageable, the funds are spent on fighting the fires.

After back-to-back fires many are saying Log It, Graze It, or Watch it burn. With that said, we don't want to promote unabated logging and landscape alterations. Common ground can be found on these issues. A steady, manageable, and proper plan for treatment across the full landscape will lead to a healthy forest and less wildfire.

A local rancher and forester told me:

"We must remember fire is good for the environment when it can burn along the ground and in a controlled manner. Fire is not good when it races through the untreated corridors of riparian area that have been untouched for 30 years or more. These untreated forests and untreated riparian areas have built up fuel loads that lead to bad fire. This is not natural and simply out of balance, just as over harvesting of timber would be out of balance the other way.

These conditions can be changed with proper management that isn't paralyzed by incessant threats and appeals. It is not a zero-sum game where it all has to burn in a devastating and expensive way to hit the reset button".

What lessons can and have we learned from these fires?

Lesson one: It all starts right here! Right here is what decides it all.

This committee hearing and the comments from those testifying will decide where we go in the future. It starts right here with you, the elected officials, who have oversight and can propose legislation to ensure these types of fire do not happen again. It starts from the agencies wanting to make the changes that are needed and being bold in the choices they make to ensure this never happens again.

For example, on a fire this summer near me, a State-contracted Cat was being used to build a fire suppression line through state and private lands. When the Cat and driver reached Forest Service Grounds, they were stopped from continuing to build the fire suppression line due to the lack of the Cat not having the federal certifications and inspections.

Lesson two: For the first time in decades, Washington put out a call for volunteers to come and help fight the fires as they were so wide-spread. With those volunteers came heavy equipment such as dozers, graders, water trucks, and people. The problem was that we did not have enough trained fire bosses and fire managers with the proper training to lead the volunteers for fire suppression. Therefore additional acreage burned.

These two examples should never have happened. If the equipment is certified to fight fire on a State-level, in disasters such as ours, they should be accepted by the federal-level or vice-versa.

It is imperative that we work to get more trained professionals to be able to lead suppression efforts in the future. This type of training should be done up front, not only to keep the volunteers safe but also the firefighters and emergency personnel who would be leading the fire suppression efforts.

Lesson three: Land is precious.

What we can all agree is that the land is precious. What we have learned over the years is that it is expensive to manage the lands, but even more so to repair the lands devastated by fire. The question is do you continue to take money out of proper

management, take away harvesting of the timber, take away recreational access, and take away grazing that assists in proper management of the forests only to have them burn up and expend twice the amount of money putting out a fire.

It is time that we end fire borrowing and put that money back into the proper management of lands to keep our riparian areas healthier, our forests healthier, and our natural resource economy vibrant in the local communities.

Lesson four: What are the cascading impacts of wildfire on our communities?

Well in Washington State, we grow some of the best apples and cherries in the world. We also have some of the best cattlemen and women who have the best beef. On top of that we have some of the most pristine views and recreation spots in the nation.

Our orchardists now face difficulties with wildlife coming into the orchards and eating the buds and limbs right off the tree causing a reduction of next years fruit production. Then, add to this the fire damage to the riparian areas; many feel that stream temperatures will rise and have a negative impact on salmon runs. This could lead to junior water right holders having their water turned off during the most critically growing time. This loss of production will cause additional economic harm to our area.

In 2015 approximately 150,000 acres of deer winter range burned; that range supports 10,000+ mule deer (Exhibit C). These deer now face an uncertain future without feed. In order to protect our agriculturists from further economic harm, requests for depredation tags could be made to reduce the herds and limit further economic damage.

Additionally, the cattle are competing with the wildlife for native grasses in unburned pasture to feed. Ranchers are having to take additional measures protect their hay stacks from the wildlife.

These same cattlemen and women have also lost the use of their range permits for 3-5 years. The fires destroyed over 700 miles of fence at approximately \$8,000/ a mile to restore. An additional 125 miles of fence within the boundaries of the Colville Reservation must also be replaced at approximately \$18,000 a mile due to the difficult of terrain. These additional costs placed onto our farmers and ranchers may leave family farms not able to financially recover and forced to sell.

Much of the fence that was burned was on National Forest Service permitted grounds where cattle grazed. The US Forest Service does not qualify for FEMA's Public Assistance program to replace these burned fences utilized for grazing grounds as the local cattle ranchers maintain the fence. That leaves USDA's Emergency Conservation Program to assist these ranchers to replace burned fence on the Forest Service lands through a cost share before cattle can be put back out on the Forest Service Permit.

That fund, however, has been depleted and if the ranchers can't afford to put the fence back up, the Forest Service could lose that grazing revenue.

These fires have also introduced a new challenge because the wildlife will be more concentrated in the unburned areas of the state along with livestock and other domestic animals. The concentration of the wildlife and other animals has brought Apex predators such as wolves, cougars, and bears closer to our towns and family farms. Bears have already been seen inside the city limits and one school had to keep kids from going to recess as a cougar was found near the school playground.

To our friends and neighbors on the Confederated Tribes of the Colville Reservation and Spokane Tribes Reservation, these fires have added additional burdens and challenges. Twenty percent of the managed timberlands on the Colville Reservation burned during the 2015 firestorms. Timber revenues make up approximately 20-25% of the annual operating budget for the Colville Tribe. That could be upwards of \$0.5-\$1 billion of timber. The Spokane Tribe estimated that the Carpenter Road Fire in Stevens County impacted \$1 million dollars of their timber, once again hitting another tribes' budget significantly.

All of these compounding impacts have placed a significant financial burden on our rural communities and our reservations.

Lesson five: "Citizens of this great nation are owners in the lands." It ought to mean something.

The tax payers of this nation are owners of the public lands be they Forest Service, U.S. Fish and Wildlife, WDFW, or DNR or other agency; and it ought to mean something.

After the Carlton Complex Fires, the Washington State House and Senate passed House Bill 2093, by Rep. Joel Kretz, unanimously. The Act:

- allows locals to access State land to help put out a fire without being held liable by the State,
- requires the Department of Natural Resources (DNR) to coordinate and share a list of locals who are qualified to fight fires and enter into agreements with them to use locals first during a fire, and
- requires the Commissioner of Public Lands to appoint both a fire liaison who will represent landowners and the public during a fire, and a Fire Advisory Committee to advise the commissioner on fire activities.

Passage of this bill was important as in the early morning hours of Friday, August 14, 2015, the same lightning storm that started the Black Canyon, Squaw Creek, Chelan (Reach), Lime Belt, and Tunk Block Fires, also started the Paradise Fire. The Paradise

fire, which you don't hear much about, was directly inside the center of the Carlton Complex fire--known as the "donut hole." The "donut hole" is just north of the town of Brewster, WA. The Paradise fire was threatening 680 acres of DNR land, 11,520 acres of Forest Service land and 10,240 acres of private lands that make up the donut hole.

The Paradise fire was reported at 6:10 AM to the DNR. DNR advised us that they had a number of lightning strikes and fires going in a number of other places and, therefore, would get to our area "as soon as possible." We advised the office that we had the necessary equipment to put the fire out.

We were given the ok to send our equipment to the fire. Our staff mobilized the necessary equipment to surround the fire and contain it from spreading. What could have been another fire that burned over 22,000 acres, was limited to 2.7 acres and out within hours.

This shows the bill worked. Utilizing local and available resources kept State-mobilized resources from being pulled away from other fires around the State and county. This also shows that local resources closer to the fires can respond quickly, effectively and efficiently. Having this same type of legislation Federally would be beneficial.

Ownership and management of these lands ought to mean something. We can no longer afford to burn up the public and private lands at over 1,000,000 acres at a time. This year burning over 9 million acres. These policy changes should include better communications and cooperation with local citizens in the areas of potential impact.

These policy changes must contain dollars for rehabilitation after the fires. The rehabilitation dollars should be used to ensure that re-seeding in the area is done, consistent with the BAER (Burned Area Emergency Response) reports. These efforts will also minimize the return of noxious weeds as well as provide for bank stabilization to prevent mudslides and floods.

These fires have left our communities with massive challenges to recovery. How do you recover from the Carlton Complex Fire when your community has lost 353 homes, over 800 head of cattle, hundreds of miles of fence along with nearly \$100 million dollars in damages? Most would answer FEMA.

The Governor's office filed for federal assistance from FEMA to help recover from the 2014 fires. FEMA arrived conducting an initial assessment for Individual and Public Assistance. Following the assessment the petition was denied for individual assistance but approved for public assistance.

We were thankful for the public assistance declaration that helped our government and public agencies restore public infrastructure. However, those in our rural community, with limited income, no insurance and limited options questioned why the individual

assistance was denied. The main reason for the denial: “the damage was not concentrated enough”. Upon learning of the reason for the denial, you can imagine we had a few choice words, but the public words were “no kidding the damage was not concentrated enough, we burned 4 times the size of Seattle”.

Now a year later, we have the 2015 firestorms of Washington State where nearly 2% of our State burned in one month. Again, we turned to FEMA and even after back-to-back incidents, the damage did not meet the subjective threshold by FEMA for individual assistance, but public assistance was granted. To say we are disappointed is an understatement.

FEMA is seeking public comment on proposed changes to their regulation describing FEMA’s Individual Assistance declarations criteria. FEMA published the proposed rule in the *Federal Register* and is seeking comments by January 11, 2016. You can be assured we will be providing written comments.

While not granting individual assistance two years in a row has been a challenge, the citizens of Washington State are resourceful and resilient. The citizens have formed long term recovery groups to fill in the gaps. These long term recovery groups and committees are organized across multiple counties from Chelan to Stevens County, including organizations within the Kalispell, Spokane and Colville Reservations. We are all working together to support those who have lost and are in need. The main recovery group is the Okanogan Complex Long Term Recovery Group, formerly known as the Carlton Complex LTRG.

These organizations have not been left high and dry, however, by our State and federal agencies. The Forest Service, USDA, HUD, FEMA, WA Department of Fish and Wildlife, and a host of other agencies have worked closely with us to assist our communities in recovery efforts. We appreciated the fact that Secretary of the Interior Sally Jewel came to Okanogan County during the fires to learn about the impacts of the fire on our communities and especially the Colville Indian Reservation.

Each agency has played a role in ensuring our communities are prepared for the next disaster. They have held multiple conference calls with our organizations and hosted a number of trainings to help us better understand how to put our communities in a better position. So while disappointed in the denial of individual assistance, we appreciate the doors that have been opened to help our community.

One particular campaign that is moving forward is called Methow Ready. The Methow Valley Long Term Recovery Organization is implementing this campaign. The goal is to have residents throughout the area and the valley be prepared with supplies and to be self sufficient in case of disaster or loss of essential services.

Senator Cantwell I would like to thank you personally on behalf of the recovery groups for traveling to our community during the Carlton Complex Fires and for your attempt to get to our area during this year's fires to meet with citizens and community leaders before being turned around as highways were closed.

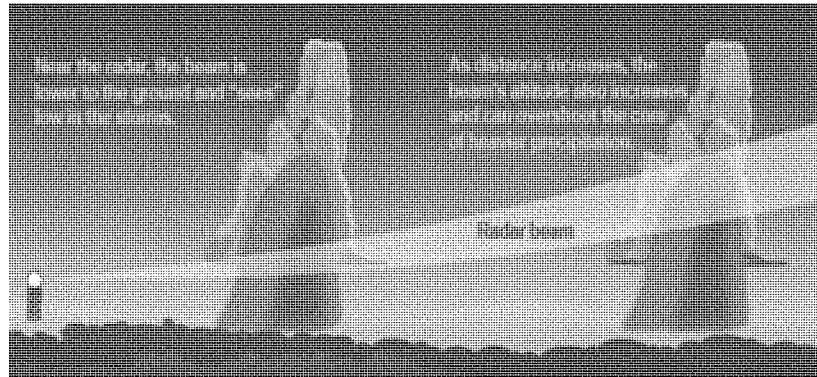
We appreciate that you held a meeting in Wenatchee and then co-hosted a meeting with Rep. McMorris-Rodgers in Spokane. These meetings with various fire chiefs, industry leaders, and elected officials continuously keep the issue in the forefront and the ideas gathered, will lead to change. These meetings may not seem like a big issue but it has given people in our communities hope that we will recover and that our elected officials are listening.

Right here and right now is our time to get it right. Thank you for your time.

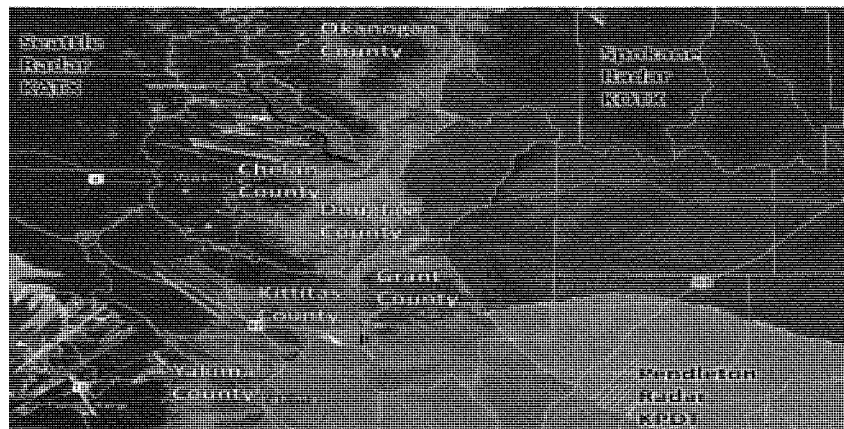
EXHIBIT A

<http://www.co.chelan.wa.us/public-works/pages/help-fill-the-radar-gap>

With all of the technology today, how can a gap in radar coverage occur?



Eastern Washington and specifically communities along the eastern slopes of the Cascades are not immune to damaging weather events or even devastating natural disasters, which range from river flooding to forest fires to summer thunderstorm events triggering flash floods and debris flows, to name a few. The result of this gap in coverage creates a less reliable weather prediction system for the NWS, thus creating a vulnerability or uncertainty for the residents, businesses, and industries that lie along the eastern slopes of the Cascades and portions of Central Washington.



This season's wildfires will leave many areas prone to severe debris flows, including areas below that are heavily populated with substantial public

and private infrastructure. Better, more accurate information will help agencies and private property owners prepare and respond to these events, potentially reducing the impacts and costs associated with clean up.

The people who call Okanogan, Chelan, Douglas, Grant, Kittitas, or Yakima counties home. Simply put, by having the ability to provide more accurate weather forecasting and emergency weather alerts, the community as a whole will benefit. Some of those beneficiaries include:

- Citizens of Okanogan, Chelan, Douglas, Grant, Kittitas, and Yakima,
- agriculture community (apples, cherries, pears, grapes, wine, etc.),
- recreational users,
- regional airports (FAA),
- National Weather Service,
- WSDOT,
- public utility districts,
- public works departments,
- port districts,
- Washington State Patrol,
- Burlington Northern Santa Fe,
- delivery companies (UPS, FedEx, etc.),
- USFS/DNR/BLM firefighting,
- Emergency Management,
- Department of Agriculture,
- Corps of Engineers,
- state universities,
- regional news stations.

- See more at: <http://www.co.chelan.wa.us/public-works/pages/help-fill-the-radar-gap#sthash.StmmEXbE.dpuf>

EXHIBIT B

(Produced by Okanogan County GIS Department)

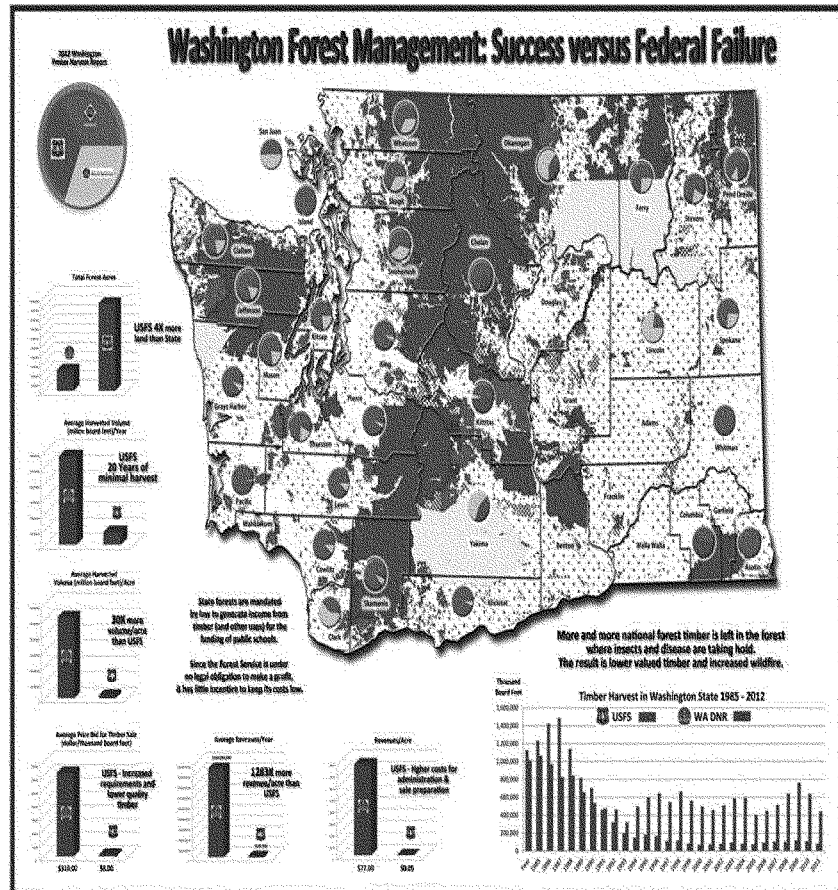
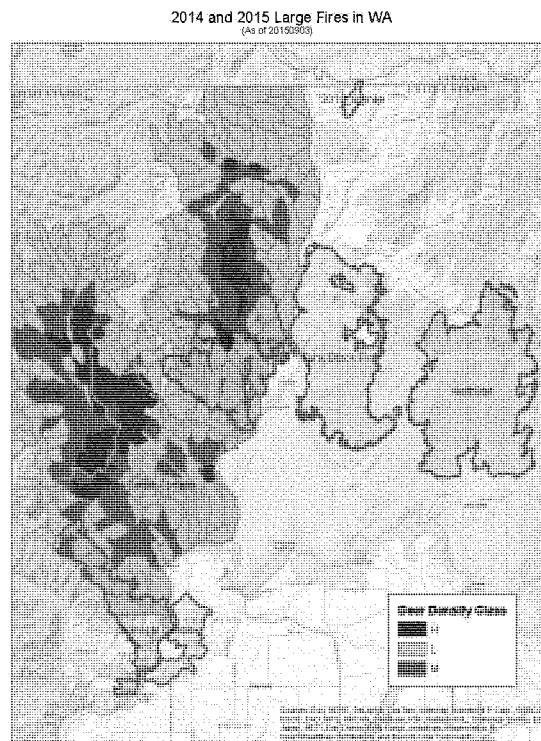


EXHIBIT C

(PAGE 20 2015 PRESENTATION BY WASHINGTON DEPARTMENT OF FISH AND WILD LIFE
TO WDFW COMMISSION)

2015 Fire Impacts: Wildlife



- Approximately 150,000 acres of deer winter range burned
- Burned area supports 10,000+ mule deer
- Need to assess full extent of impacts to shrub forage base

The CHAIRMAN. Thank you, Mr. Wyss. Your testimony reminds us that there are true consequences, unfortunately, very tragic consequences when we fail to manage properly. There is a lot of discussion around these halls about needing to end fire borrowing, and it is more than just about money. We have to make sure that we have the resources, but I think we also recognize that we have some management issues that we have to deal with. We need to make sure these resources that we direct are spent wisely.

So to listen to some of what you have just pointed out, what Mr. Maisch has pointed out, what Mr. Zerkel has pointed out, in terms of the lack of coordination, the double standards, the failure to manage some of what we are looking at, these are some of the concerns that I hope we will get out on the table today as we try to address the bigger picture that we are facing and again, the ever increasing threat to our forests.

I wanted to ask a little bit about aviation coordination. Mr. Maisch, you brought it up initially, and I think, Ms. Fennell, you alluded to it a little bit with your discussion about the aviation assets.

It is really discouraging, extraordinarily discouraging, to hear that you have different standards for aircraft used for fire suppression between the Forest Service and the Department of the Interior and that you can literally be poised to move in to address the fire and you are held back because you do not have the proper certification. You do not have the aircraft carded.

How do we get around this? Mr. Maisch, you have been dealing with these different standards and you see how it impacts the efficiency and the ability of our agencies to effectively engage in these fire suppression efforts. What do we need to do here? It should not be this hard, and we have had hearings before this Committee that I have been part of where we say, particularly in a state like Alaska where you have got your BLM lands, you have your Forest Service lands, you have your State lands, and you have tribal lands. The fire does not care whose land it is. The fire is going to go where the fire is going to go.

Why can't we do a better job with this interagency coordination? What do we need to do? I will start with you, Mr. Maisch, and anyone else that would like to contribute is welcome to join.

Mr. MAISCH. Ah yes, thank you, Senator, for the question.

It's a good question but unfortunately it's not an easy solution. We've been working on this for several years to try and streamline and get the two agencies to basically have a seamless process that if one agency cards a ship, it's good to go. It's not another cooperator letter or another carding process that it has to go through. They are carding to the exact same standards, so it's very perplexing.

The CHAIRMAN. Then if they are carding to the same standards, why do you have to have multiple cards or multiple certifications? That makes no sense.

Mr. MAISCH. That's an excellent question. I wish I had an answer for you on that, but we've been frustrated for years. And you see the about eight examples we gave, specifically in the written testimony, about other examples around the country. Incidents hap-

pened in Oregon, Nevada, Alaska, Montana. So it's not just a one off situation, unfortunately.

And the point I made about treating the states as equals and allowing them to basically modify the agreements we currently have with the Federal Government to reflect that if one agency does the process and approves the ship and the pilot, it's basically good to go across the board. And it's basically some bureaucracy there.

The CHAIRMAN. Does anyone else have an answer for how we address it? I hear the frustration. We all have the frustration, but it ought not be this hard and recognizing that we do have the same standards that should be okay.

What Mr. Zerkel raised with the standards that we have between the commercial aircraft and the government-owned aircraft that, to me, is absolutely unacceptable. You go with your highest standard, and those set by the FAA, it seems to me, makes sense. But to have safety standards that are less, if a government-owned aircraft verses a commercial aircraft, we have got to get that one worked out.

Ms. Fennell, do you have any observations based on your reviews?

Ms. FENNELL. We haven't looked specifically at the carding issue that is mentioned here, but we did note in our reports that there are challenges associated with collaboration amongst the agencies. And in fact, for one of our reports we did have a recommendation where we called for enhanced collaboration amongst the agencies in terms of looking at the performance of aircraft.

But to date—

The CHAIRMAN. We have been doing that for years. This is not a case of first impression here. This has been going on for years. I am just stunned that we are not any better, not further along.

Let me turn to Senator Cantwell and then we will come back for a second round of questions.

Senator CANTWELL. Thank you, Madam Chairman.

There are a couple things I wanted to mention before I ask questions.

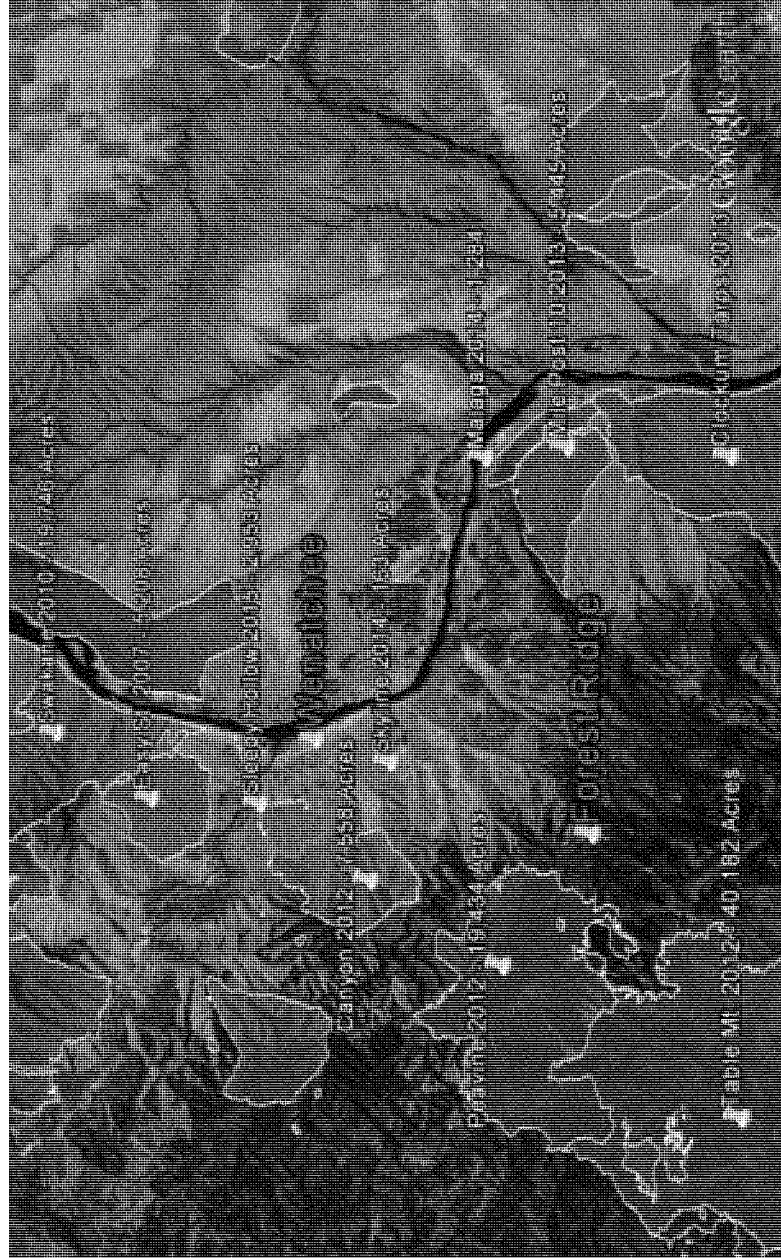
First of all, Mr. Wyss, thank you and Gebbers for everything you did in the Carlton Complex. I think you are talking in testimony about so many things. You mentioned it, but I do not think it really is crystal clear what you were saying that is that you and individual citizens and employees of Gebbers basically went out and held the line and really prevented a lot more acres from burning and did an incredible job of also helping the Town of Pateros. So thank you, and thanks for being here.

Chief Burnett, thank you so much for everything that you have done over these fire seasons and for helping us illuminate some of the issues about what I have heard on the ground in Washington State that I just call hasty response, which is just how can we be more active in using people to jump on fires immediately when they start. So thank you for articulating that.

I also want to mention that last night the Forest Service did announce \$300,000 to Chelan for recovery.

But I wanted to get to these handouts I gave my colleagues. So if we could put these up, there are handouts that actually show three slides.

One, the 2012 Wenatchee Complex and fires.
[The information referred to follows:]



Wenatchee Complex in 2012, surrounded Wenatchee, WA with 60 separate fires

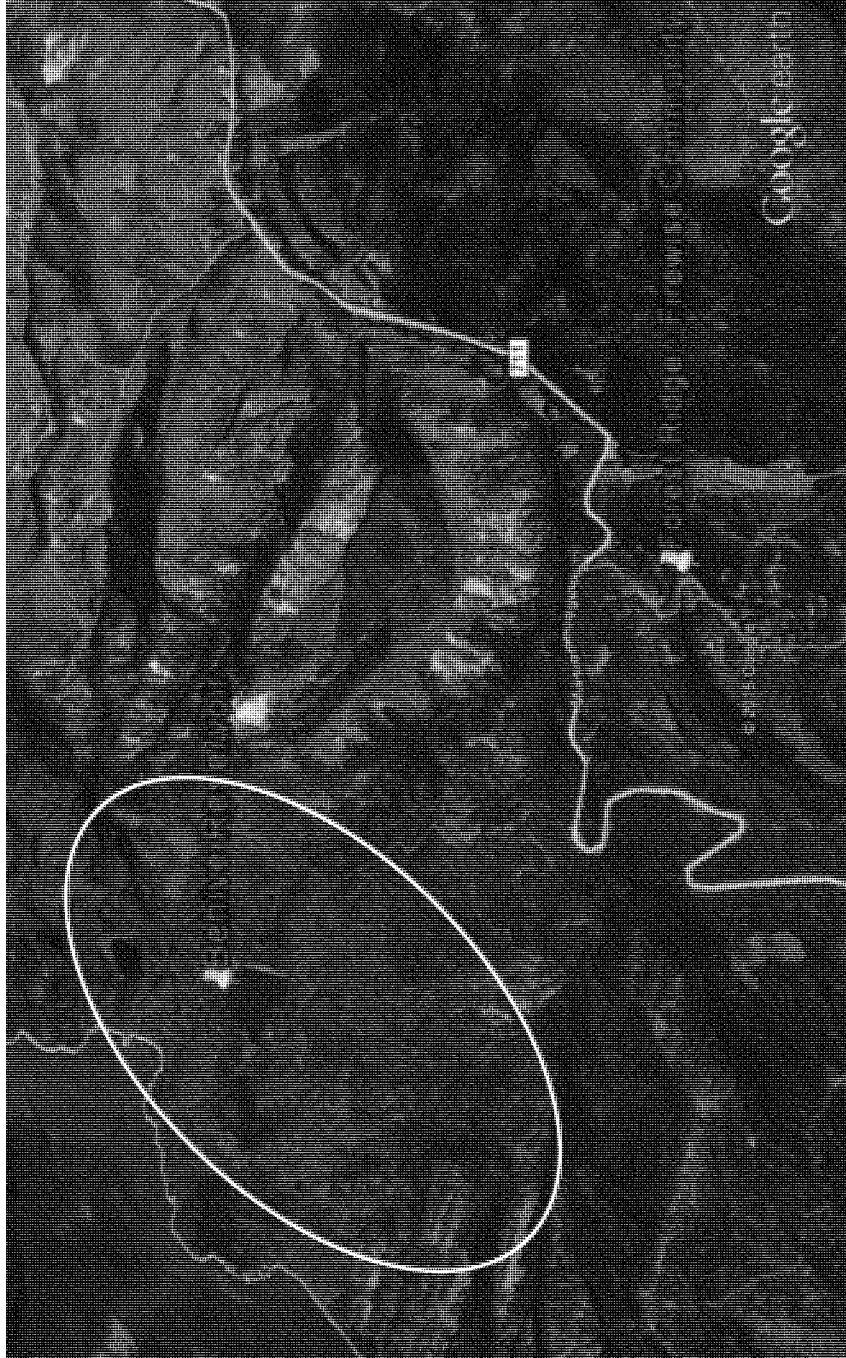
One thing, Mr. Burnett, you did not mention when you kept saying warehouses were burned down. Could you explain to people what was in these warehouses?

Mr. BURNETT. Yes, the community of Wenatchee, we lost approximately \$110 million worth of assessed value. The fire spotted from the Broadview neighborhood over a mile into an industrial area, took hold initially in a recycling plant and spread to the roofs of a chemical warehouse storage building and then spread to two large fruit packing plants.

So yes.

Senator CANTWELL. All of this is the home to the apple industry in Washington State and why it is so—okay so the next chart demonstrates the Beehive Reservoir.

[The information referred to follows:]



So the red is encroaching fire from this season and the community that was trying to be protected. This Beehive Reservoir area is where you did actual treatment. Is that correct?

Mr. BURNETT. Right. So you can barely see it there, but the Forest Ridge neighborhood is a Fire Wise community. They've taken a lot of efforts to protect the approximately 70 homes that are there, and we've done grant funding with them to do fuel modifications right around the neighborhood. We've tried to partner with the state agencies as well as the Federal agencies on choosing those areas where the fuel treatments would be best suited.

The Beehive Reservoir has had a lot of fuel treatment around there by Forest Service and that fire that, you see the perimeter, is the Peavine fire that was coming into, threatening that area. It's less than two miles away. The fuel treatment in Beehive Reservoir area was significant in controlling the fire.

In 2012, the Wenatchee Complex had over 60 fires that we were dealing with and so being able to allocate a limited number of resources in that area on a fire suppression effort that took a minimal amount of resources was significant for us.

Senator CANTWELL. Well and fuel treatment, you are saying that was a success in a year that we actually even saw places where the fire jumped the Columbia River. So we had extreme weather conditions blowing that up.

Mr. BURNETT. Yes.

Senator CANTWELL. So can you go to the last page which I actually wanted Dr. Covington or Mr. Wyss to comment on. This is an up close of the area that Bryan Petit from our staff was just there visiting.

[The information referred to follows:]



You can see on one side of the road the treated area, and on the other side the burned area, so basically it did not jump over to the other side of the road.

I think one of the most important things that you said in your testimony is this issue about surface to crown. From our state agency, from our DNR Director and everybody, it is all about the crowns, right? The ferocity of our fires are from crown to crown.

What we are talking about here is reducing the ability to get to crown level by basically reducing the surface timber. So if you wanted to further elaborate on the challenge that we have with all this Ponderosa Pine not having been treated for some time and what that means as far as the ability to go crown to crown and the kind of devastation we're seeing?

Dr. COVINGTON. Yes. So about 90 percent of our mega fires are in the dry forest types in the West. This last season we saw mega fires in areas where crown fires are normal, just not crown fires of that size, of the size that we encountered. So they are separate problems.

On the one hand with frequent fire forests, like Ponderosa Pine, they were originally, before fire regime suppression, were open and park like. The fires naturally burned through the understory. The plants and animals were adapted to these fires. These fires are easy to control, if you want to control them, although it's not always clear why you might want to control surface fires.

As the forest filled in we moved from a frequent fire regime in Ponderosa Pine to a crown fire regime. So we essentially created the kinds of fuels that occur naturally in Spruce, Fir and Lodgepole Pine over tens of millions of acres throughout the West. So the solution in that type is restoration, is thinning out the post-settlement trees, conserving the old growth trees which are so important for wildlife and aesthetics, biodiversity and then reintroducing natural fires, fires that would burn on the two to maybe, 15 year interval.

In the crown fire types, in Spruce, Fir, like in interior Alaska, Lodgepole Pine types, we have a different problem. There the fires have always been crown fires but they were smaller crown fires on the scale of like in the case of the Yellowstone ecosystem, somewhere on the order of 100,000 acres, 200,000 acres. But what we've seen over time with fire suppression is that we get an area that's ready to burn now. Fifty years from now being adjacent to five other areas that have accumulated crown fuels to the point that they'll support fires, it's a lot easier to fight a 100,000 acre fire where you know that's as far as it's going to go than it is a million acre fire.

When we're dealing with mega fires we—this is very recent. We just don't have the capability to deal with fires of that size, so the restoration in that area of sizes, it's patch sizes, involves putting in fuel breaks.

If you weren't worried about aesthetics, it would probably be clear cut fuel breaks between these different patches to break them up so that they can then burn at a more normal size.

Senator CANTWELL. Thank you. And thank you, Madam Chairman, I know my time is up.

The CHAIRMAN. Senator Daines?

Senator DAINES. Thank you, Chairman Murkowski and Ranking Member Cantwell for holding this critically important hearing.

I have got to say I am tired of talking about this. I want to see action out of Congress. We need to do something.

Like much of the West, Montana had a very difficult fire season. Over 300,000 acres burned, multiple evacuations of populated communities were ordered. In fact one firefighter from Stevensville, Montana was the only survivor of that four member crew where three of them lost their lives in Western Washington that was referenced twice in this hearing already.

This year's fire season demonstrated the need for a strong wild-fire funding solution that is a support of the Wildfire Disaster Funding Act. I strongly believe Congress should relieve the Forest Service of the suppression costs of fires that are truly natural disasters, but at the same time the fire season also demonstrated the urgent need for restoration work to be done in Montana and other parts of the country.

Consider, for example, lessons of the Bear Creek fire in the Flathead National Forest. I was up at the Incident Command Center of West Glacier here when the big fires in Glacier were burning this summer. Bear Creek is not too far away.

It was incredibly hot with flame lengths reaching 100 feet. As the fire progressed to the Meadow Creek trailhead, it went to a spot where we had a recently completed a thinning project. However, when it hit the recently completed thinning project, guess what happened? It settled down considerably.

Local Forest Service officials said the thinning project really worked. That is the good news. Now here is the bad news. The thinning project was part of the larger Spotted River project that was hamstrung by litigation for several years. According to non-partisan research done by the Bureau of Business and Economic Research at the University of Montana the case was in court for over 1,000 days. So instead of planning for a new forest restoration project, 18 Forest Service personnel spent nearly 2,000 hours responding to the lawsuit.

Further, the study found that over 100 forest project jobs were threatened. It pointed out that the litigation delayed efforts to improve recreation access and wildlife habitat. I was chasing elk just this last weekend in Montana, and you hear both the quantitative as well as qualitative stories about when you thin the forest it improves the habitat for the wildlife.

It is quite possible that the work that was upended by the litigation could have further mitigated the damage when that fierce, fierce, Bear Creek fire swept through. The Forest Service ultimately prevailed in court, but the impacts of litigation against this project and many, many others are extensive and they are severe and they should not be accepted.

I urge my colleagues on both sides of the aisle, let's come together and pass a wildfire funding solution as well as timber management that includes some litigation reform so we can move forward here and protect our forests, protect our jobs and protect the lives of the men and women who fight these fires.

Dr. Covington, you talked about the importance of thinning and prescribed burns, you also talk about the dangers of excessive

stand densities. Do you think that providing the Forest Service with additional tools such as expanded categorical exclusion authorities could help the agency get substantially more restoration work done?

Dr. COVINGTON. Yes, of course it could. One of the problems that we've solved, I think, in a lot of the collaborative work is that when you get local people together to support a project, if you have strong, local, political support, you can, kind of, head off legal action that might otherwise stop a project.

So there's the one approach that you're describing is let's have more categorical exclusions and that, obviously, if that could get through, you'd still have potential political blow back from it that could slow a project down.

If you have local, political support that's well organized and engaged in it, in many ways I think that would be more robust.

Senator DAINES. Yes.

Mr. Covington, in addition to, I think, that reform is needed, would include incentives for the collaborative efforts as well.

It is working in Montana. The problem is the extreme environmental groups that litigate the collaborations are not part of the collaboration. They are waiting at the courthouse to file the lawsuit once the collaboration wants to move forward.

Dr. COVINGTON. That's right, and so it seems to me, Senator Daines, that there's, just like there are variations across the landscape in fuel accumulation and forest types, there are variations across the political landscape that make different solutions more helpful in one area than in another. And we don't typically analyze that.

Senator DAINES. Right.

Let me ask one last question, Ms. Fennell, because my time is out.

Ms. Fennell, I think performance metrics and accountability are vital and thank you for being here. You note in your testimony that the Forest Service is beginning to improve at understanding fuel treatment effectiveness.

Do you have any other thoughts on how Congress can further enhance accountability on the agency in terms of both finding the most effective fuels reduction treatment for a given area and in maximizing the amount of effective fuels reduction projects it does each year?

Ms. FENNELL. Senator, I think it would be important to continue oversight in terms of the new efforts that they are putting into place regarding looking at the effectiveness of their fuel treatment program. They—we noted in 2007 that, they did not have sufficient information by which to evaluate the effectiveness of the fuel treatment programs, and therefore had impacts in terms of how they would allocate the resources accordingly.

Since that time they have established a new system called the Fuel Treatment Effectiveness Monitoring Program. It is in process, and I think it would be important to continue oversight over it to see how it's progressing and whether it's getting the information that's needed to evaluate the effectiveness of the fuel treatment program.

Senator DAINES. Thank you. I am out of time.

The CHAIRMAN. Senator Heinrich?

Senator HEINRICH. Thank you, Madam Chairman.

Dr. Covington, I want to start with you, and I want to start with a thank you actually because I think in oh, seven years of Natural Resources Committee meetings on both sides of the Capitol in both the House and the Senate, I think you are probably the first person to succinctly articulate that we need different strategies for different forest types and that what works in a Ponderosa Pine forest that should be burning every 2 to 15 years is not exactly the same prescription that we are going to need in a closed canopy forest, be it Spruce, Fir, or Lodgepole Pine further north. I think that is really helpful.

I think we tend to oversimplify things here in Washington, but I think that comes with the territory.

You said you used the phrase, "an ounce of prevention is worth a pound of cure." I think we all wish that everyone agreed with that approach, but one of the challenges we have had has simply been being able to show and justify the restoration efforts and show that they actually do pay off economically in the long run. And that goes back to the question that Senator Daines was raising as well about evaluation of those.

Can you talk a little bit about data capture and particularly one you are able to wrap things in like the potential impacts to municipal water supplies and soil impacts, about the cost effectiveness of being able to do, especially these Ponderosa Pine, restoration projects rather than waiting for these areas to burn and starting from scratch?

Dr. COVINGTON. So quickly then there. We have studies where we've approached this two ways.

One is looking at areas that have already burned over, large landscapes and then examining the portions of those landscapes that had been treated before with restoration treatments. And repeatedly what we see is that in areas where the forest had been restored to more natural conditions they stand up, even under the most severe fire conditions.

Senator HEINRICH. Right.

Dr. COVINGTON. They survive well. Fires burn through the understory, and then once they get out of the treatment they get up in the crowns again and run.

These kinds of fuel breaks, restoration-based fuel breaks in Ponderosa Pine, we see have saved houses, have saved entire communities as well. In the back country this works also to protect Mexican spotted owl nest sites and other highly-valued portions of the landscape. So one way is an ex post facto is to go out there, see what happens and the evidence is overwhelming. It works.

The other thing that we've done is what I mentioned in my testimony, is we've looked at fires and then analyzed what the potential fire behavior would have been had treatments been put in elsewhere. When we do that sort of analysis what we see is, by breaking up landscape scale fuel community, continuity.

Senator HEINRICH. Right.

Dr. COVINGTON. You can protect values at risk, including homes, where if embers are coming two to four miles away.

Senator HEINRICH. Gotcha.

Dr. COVINGTON. Being dropped into communities.

Senator HEINRICH. Thank you.

I want to shift real quick to Ms. Fennell. I want to start by just saying that I think it is clear that at this point using the 10-year average to budget for fires is no longer working for us. If you look back at the last 9 of 11 years, using the 10-year average has underestimated the Forest Service's suppression costs 9 out of those 11 years and it was actually 40 percent below actual costs during that period.

With the climate shifting that we are seeing we do not see that trend exactly slowing down, so the ten-year average standard was created at a time to ensure that in most years the agencies would have the funds that they needed to cover those costs. That is not what we are seeing work out today.

So if that no longer works as a construct do you have advice for how we should be budgeting for something that can be as variable as fire suppression costs from year to year?

Ms. FENNELL. Senator, we haven't specifically looked at that particular issue as part of our current effort. I think the last time we looked at various options available for legislative action was about 2004. We noted that there are various pros and cons with each approach that's taken, but we haven't specifically looked at the current issue that you're raising as part of our current work.

Senator HEINRICH. Does anyone else have a comment?

Mr. MAISCH. Yes, I'd like to respond to that.

We do much the same in the state. We talk about a 10-year average and budget for that but what we found, as you alluded to because of changing weather patterns and climate, you have these extreme events much more frequently. And it's hard for a 10-year average to fit to that kind of a scenario.

So you really need the flexibility from an agency perspective to do a disaster declaration which is what we do in our state and the supplement suppression accounts when those kinds of events have occurred. You've got to have some kind of system that allows that flexibility because it's hard to anticipate the kinds of events that we're seeing.

Senator HEINRICH. That is helpful, thank you very much.

The CHAIRMAN. Thank you.

Senator Barrasso?

Senator BARRASSO. Thank you very much, Madam Chairman.

You know this year is another example why it is a necessity to conduct more prescribed fires, perform more fuel reduction treatments and undertake more vegetation management projects to thin our unnaturally, overcrowded forests. According to the Forest Service between 62 and 82 million acres are in need of treatment and are at risk of catastrophic wildfire over 40 percent of the entire National Forest system and the number is growing.

We simply cannot allow the status quo to continue. That is why I have introduced S. 1691, a bill called the National Forest Ecosystem Improvement Act. It is designed to make treating our forests a priority it needs to be.

The Forest Service also states specifically there are about 12 and a half million acres in need of mechanical treatment such as thinning. With these numbers in mind do each of you agree that

Congress must take action to increase the pace of treatment using both prescribed fire and mechanical methods to restore forest health and reduce the severity and the size of wildfires?

Everyone agrees with that? [Witnesses shaking heads yes, simultaneously.]

Senator BARRASSO. Alright.

Dr. Covington, in your written testimony you say it is too late to use controlled burning alone to protect communities and restore forest health. You then explain why first thinning and removing unnaturally high tree densities and then introducing fire produced stunning results. Would you elaborate on why you think it is too late to just use controlled burns alone and what are some of the stunning results that you are seeing?

Dr. COVINGTON. Okay. So when I first started out in this work back in '75/'76 I was pretty much thinking that if fire exclusion had caused this problem you just put fire back in. It ought to solve the problem, and so I embarked on a 6-year program of study working with cooperatives with the Forest Service to try this.

What we found in dense forests of Ponderosa Pine which is 95 percent of the Ponderosa Pine type is that we could not develop a safe prescription. On several circumstances we had fires get into the canopy, become independent crown fires and fortunately we had enough suppression force around to knock them down again. But I was on the verge of becoming the shortest lived professor in the school of forestry. I would have been fired if we'd burned up the San Francisco Peaks from those early experiments.

Then that caused us to look at thinning out the post settlement trees to try to restore natural conditions, and those first experiments have just been so stunning. We've now done this throughout areas in the West, especially Arizona, New Mexico and Colorado. What we see is old growth trees that have put on no growth at all for decades start growing like teenagers. We see abundant grass production and wildfire production understory, a tremendous blossoming of birds, songbirds, butterflies and everything. So every aspect that we look at in forest health shows that these work.

The difficulty that we've got, Senator Barrasso, is not all areas are accessible for being able to remove all of the biomass and the thin material. So a problem that we're dealing with right now is trying to figure out how can you do onsite disposal of some of these materials while not creating excessive fire hazard or dumping a lot of smoke into the atmosphere. We're talking about putting a lot of treatments down there around urban interface areas, and that's where people live and people have asthma and they have lung diseases and they like to breathe clean air. So right now we're putting a lot of focus on how we can deal with that biomass issue.

Senator BARRASSO. In terms of this wildland urban interface that you just made reference to, you also write about the reduced mega fire potential when treatments in all high risk areas were performed verses treatments only in the wildland urban interface. Why are the risks of the mega fires reduced when treatment is not limited to around communities only but also treating the greater landscape as a whole?

Dr. COVINGTON. Well, thank you for the question.

The treatments around communities are designed to protect houses, primarily, you know, to help out with fire department operations. When you're talking about mega fires across the landscape, that's only 5 percent or less of the landscape in most circumstances. In the back country is where we have our natural resource values, the watershed function, biological diversity, wildlife, recreation opportunities and so on. So I don't think anyone wants just the houses in burned over landscapes.

I had one study area over in Los Alamos back with the Cerro Grande fire. This one elderly couple had a brick home. They had cleared out around their house. It survived the Cerro Grande fire. They got smoke damage payments. All the houses around them burned, but they didn't want to live in a burned over landscape. Out back, you know, from their door was a wonderful little canyon that just burned to a crisp, killed all the old growth trees. And ironically on their property there was an old growth tree that had been labeled in Forest Service research in 1911—it was 480 years old—that had survived. It had fire scars on it. It survived 40, 50 fires, and then in that one fire it burned up.

So most people that are living in this country don't want their cabin or their house or their subdivision in a burned over landscape. So we've got to look at it in the whole habitat point of view, I think.

Senator BARRASSO. Thank you.

Thank you, Madam Chairman.

The CHAIRMAN. Senator Stabenow?

Senator STABENOW. Thank you very much, Madam Chairman and our Ranking Member for holding this hearing. These are very, very important issues and it is interesting to me that I find myself on the Agriculture, Nutrition and Forestry Committee, Energy Committee and Budget Committee, I am, I think, the only member on all three committees that are touching all of this, and it is incredibly important.

Let me start out by saying we just held a hearing in the Agriculture, Nutrition and Forestry Committee a few weeks ago, and we found amazing consensus around the issue on the budget and on Senators Crapo and Wyden's bill. In fact it was interesting. Every single person that testified from across the political spectrum was saying that we needed to start the wildfire discussion by fixing the Forest Service budget and the Wildfire Disaster Funding Act. So I want to applaud Senator Wyden and Senator Crapo for that because I do think when we are looking at mega fires, like you have been talking about today and natural disasters, that it is incredibly important that we understand what is coming and more and more and deal with it in a different way.

I would like though to start, Mr. Maisch, with talking about what happens, because we are taking all the funding. I mean, we passed a Farm bill in 2014 with the most robust funding we have ever had in a forestry title to try to get ahead of things by doing it and creating a number of tools to deal with prevention and so on. All that money is going to fight the fires, so we are not able to get ahead of it.

Because you concluded in your written testimony support for the Wildfire Disaster Funding Act, I wonder if you might talk some

about the basic Forest Service functions and programs in Alaska that are suffering because the agency is forced to spend so much of their budget on wildfire suppression?

Mr. MAISCH. Ah yes, thank you for that question, Senator.

It's not as much in Alaska as in other parts of the country because, of course, the Tongass is not a fire driven ecosystem. So there's different issues affecting the Tongass of which I'm sure we don't have time to go into. But I can speak to the issue of more active management on Forest Service lands.

When they have to divert funds, essentially borrow funds, to pay for suppression costs it takes away from all the proactive activities, pre-commercial thinning, commercial thinning, restoration work. You can almost name the type of activity. It restricts the funds available for that type of work.

I think you heard from everyone on this panel and as you alluded from other panels that you've heard from that you have to get in front of this problem. You have to be proactive, and you can't just pay for fighting fire. We need to pay to prevent fire where we don't want fire.

Senator STABENOW. Thank you.

To that point, Mr. Burnett, I wondered if you might speak a little bit more to the fact that our forests are not just on Federal lands, as we have all said, or even on state lands, there is private land as well. And our private landowners and states have a huge role in making forests more resilient to wildfire, both to protect lives and property and safeguard drinking water and so on, all the issues we have talked about today.

We have worked again back into what we did in the forestry title of the Farm bill to expand what is called Good Neighbor Authority a couple of years ago, and we have seen some Good Neighbor Agreements signed recently in Wisconsin and Michigan that are positive.

I wonder if you could speak a bit from your experience to the importance of forest health efforts between Federal, State, and private land boundaries and what types of policies and concepts should we be thinking about as we build on the Good Neighbor Authority?

Mr. BURNETT. Thank you, Senator.

So it is not just a Federal issue. The local fire districts are your first line of defense in protecting those homes that are in the wildland urban interface. The homeowners also have to understand that they have a responsibility to help harden their homes and to take the efforts to reduce the fuel around their homes. They need to work as a community.

The Sleepy Hollow fire, part of the neighborhoods that were affected, had defensible spaces around them and we were able to steer the fire around that. It got into the Broadview neighborhood and those homes are tightly packed together and they're sitting right on top of a ravine that has old growth sage in it. When the fire hit that it came up over the homes and was basically a tidal wave of flames, and there's nothing that we could have done to protect those homes. It is not just the Federal efforts, but it is the local efforts as well. The city of Wenatchee has enacted the WUI fire codes from ICC, and those types of efforts need to happen both

on a city and a county level to help us give us the tools to be successful when the fire does come into a WUI interface area.

Senator STABENOW. Thank you very much, Madam Chairman.

Senator RISCH [presiding]: Thank you, Senator Stabenow.

Senator Gardner, you are up.

Senator GARDNER. Thank you, Senator Risch. And to the panelists, thank you for being here.

According to the Congressional Research Service, since 2000 we have had an average of about 74,000 wildfires burning an average of 6.6 million acres. We have talked about the numbers and how 7 of the past 11 years have been beyond that. During the 1990's the annual average of burned acres was 3.6 million acres.

So I appreciate the work Dr. Covington is doing and appreciate the presence in Colorado at the Institute. We have obviously felt the burn as well in Colorado in terms of the forest fires and the destruction that has occurred.

In June 2013 the Black Forest fire, northeast of Colorado Springs, saw 14,280 acres and 488 structures destroyed. A year earlier in June 2012 the Wallow Canyon fire, outside of Colorado Springs, saw 18,000, nearly 19,000 acres burned and 346 homes destroyed. In 2012 we saw the High Park fire in Larimer County destroy nearly 87,000 acres and 259 structures. In 2010 the Four Mile Canyon, northwest of Boulder, saw 6,000 acres burned and 170 structures burned down. And of course, one of the most infamous wildfires in Colorado history occurred in June 2002 when the Hayman fire burned 136,000 acres and saw the destruction of 600 structures.

While we have experienced significant wildfires over the past 15 years, our state's development, like the rest of the country with an interest to fire developing in the wildland urban interface, as we have talked about here this morning. According to a 2007 Colorado State University study between 2000 and 2030 there will be a 300 percent increase in Colorado's WUI interface from 715,000 acres to more than 2.1 million acres.

Building upon that study in late October of this year the American Forest Foundation came out with a report on wildfires that highlights areas of our nation that are most at risk for wildfires and threat to watersheds. The analysis found that there are 52 million acres at high risk for fire on private land, on family forest land in addition to the 93 million acres on public land. Of these 52 million acres, 1.3 million of them are in Colorado.

And so, Mr. Burnett, I have a question for you. Given that you serve in an area of Washington with significant fire risk that also has considerable wildland urban interface, what steps do you think we should take to address the risk to private or family forest land?

Mr. BURNETT. As I said before, the rural fire departments are staffed with primarily volunteers, and there's a need for additional resources to make an initial attack and keep the fires small and prevent it from becoming one of the larger fires. The ability for us to extinguish the fire on that initial attack is critical.

I mentioned the fact that we need the ability to activate air resources in order to fight those fires and not wait for the Federal or State agencies to come in to assist us with that and to call for those assets. I think that's my answer.

Senator GARDNER. Yes and I think at the beginning of your testimony you talked about four points. I think you talked about education, quick attack, fuel reduction, and aerial response.

Mr. BURNETT. Yes.

Senator GARDNER. When it comes to aerial response in Colorado there has been significant debate about whether or not there should be a state aerial firefighting fleet. Is that something that you have seen in Washington or other states looking at that?

Mr. BURNETT. Yes. The Washington State Department of Natural Resources has eight helicopters available for deployment. Chelan County Fire District One actually has a UH1 medium helicopter that we acquired years and years ago. It was leased to DNR for many years and then they built up their fleet and decided that they no longer needed it.

As you've heard in testimony here, our helicopter is not available to be utilized on State and Federal fires because our pilots aren't carded for long line operations. The helicopter itself is carded but not our pilots.

Senator GARDNER. That is something I think that we have seen in Colorado too, because down in the Southwest corner of the state where you have the narrow gauge railroads and you have a privately-owned railroad that draws thousands of tourists every year. The railroad company has a firefighting fleet but they are restricted to activities within 50, I cannot remember the number of feet, the right of way that they are allowed to act in, but if they go beyond that they get in trouble from the Forest Service for trying to put out a fire.

I understand the Forest Service has to try and protect themselves and make sure that people are taking safety into account and doing the right thing, but do you see the Forest Service willing to work with you and others on this certification issue so that we can address questions like this railroad issue to allow more private resources to be brought to bear, to allow the state to be able to provide resources more timely when available?

Mr. BURNETT. There have been efforts regionally for us to be able to utilize our helicopter, for example. Two years ago we would have to set down when the State or Federal helicopters entered into the air space. Last year we were allowed to actually continue flying when they entered into the air space, but they will not call or utilize our helicopter.

Senator GARDNER. I know I am running out of time.

Ms. Fennell, has GAO taken a look at some of the ways that our Federal disaster designations work? Here is what I mean by that question. If you have a significant burn we know that any significant moisture event after that fire is going to result in flooding because of hydrophobic soil conditions and other problems that occur. Oftentimes though that next or that secondary disaster is not included in that first disaster and people have to go back and re-apply, resubmit, adding cost when if they were able to address the damage done to the soil conditions to prevent that flood from occurring which you know will occur because of the next moisture event, you would have saved money in the first place. Has the GAO done any kind of look into whether we could be more efficient and effec-

tive with the initial disaster dollars by preventing the secondary disaster that comes from a fire?

Ms. FENNELL. We haven't specifically looked at that particular issue, but we would be happy to work with the Committee staff in terms of any interest in terms of looking at other, perhaps relevant GAO disaster work that could be applicable to this particular situation.

Senator GARDNER. Very good, thank you.

Senator RISCH. Thank you, Senator Gardner.

I am going to exercise the Chairman's prerogative here and just say that I think, probably, Mr. Zerkel might have some thoughts on that exchange between Mr. Burnett and Senator Gardner. Would I be correct on that?

Mr. ZERKEL. Pertaining to?

Senator RISCH. The aerial firefighting that was referred to in the exchange between the Senator and Mr. Burnett.

Mr. ZERKEL. Well I can say that from our perspective the method by which the Forest Service wants to operate the C130's that they're designated is probably not the best way to go about it, that public use format. And that's really our message today is it is a poor way to go about operating aircraft.

Industry has very rigid standards that must be met in order to modify an aircraft, such as putting a tanker into it. Under that public use aircraft format those rules are not applicable. I'm not saying that they don't do a good job of engineering or whoever they get to do it wouldn't do a good job of engineering, but there is not prescribed process to make sure there's no pieces missing, no holes that haven't been filled, and that's the real danger of that type of operation.

Senator RISCH. Thank you for thoughts, Mr. Zerkel.

Mr. MAISCH. Senator, might I add to that answer?

Senator RISCH. Please.

Mr. MAISCH. Yes, thank you.

I didn't answer a question earlier from Senator Murkowski as well as I could have on this topic of carding, but you did have an excellent example in Colorado this year of this which illustrates this problem. You have a multi-mission aircraft the State owns. It was requested on an infrared mission in Oregon. The aircraft had been carded in Region 2, the Forest Service region, in your area and then it went over there to Region 6 and had to be re-carded again. So that's the situation, and I think the way to get at fixing this is we have various memorandums of understanding, cooperator standards, and mobilization guides that the agencies use to move things like this around the country. We need to ensure that those agreements with the states and the agencies recognize each other's standards and will accept them right up front, so there's no more of this back and forth well, it's Region 2, it's Region 6, it's OAS. Those agreements have to explicitly state if it's carded in one jurisdiction, it's good to go nationally. I think that would really help.

Senator RISCH. That unfortunately makes too much sense. [Laughter.]

Senator Franken?

Senator FRANKEN. Thank you, Mr. Chairman.

I heard Senator Gardner say that Colorado felt the burn, and I was actually at the HELP Committee with Senator Sanders and apologize for not being here but I am sure that he appreciated the shout out. [Laughter.]

And—

Senator GARDNER. I was hoping nobody was paying attention as those words left. [Laughter.]

Senator FRANKEN. I did.

Last night I read a lot of the testimony, and we are hearing common themes about the balance that is spent of suppression as opposed to prevention, the balance shifting, of course, to suppression. Also in prevention you are trying to get rid of hazardous materials as part of that. And then we heard just a lot of talk, a lot of testimony about the wildland urban interface. I would like to see and I think this is an opportunity for helping to pay for the removal of hazardous fuels from the, especially from the wildland urban interface, if we use this waste as a source for electricity because this would put a value to that biomass and also reduce the risk of fire in that space which as all the testimony says is growing. We can utilize this in terms of combined heat and power and other facilities that use woody biomass.

Dr. Covington, let me ask you, are there places where forest waste is being used for biomass electricity generation, and what are the benefits of that from a forestry perspective?

Dr. COVINGTON. Yes, there are a number of places throughout the West where biomass, the slash material that's not suitable for making traditional dimension lumber or engineered forest products are being converted to electricity. So that technology exists. It's mostly an older technology that's there.

So for example, in Arizona we have a plant that takes biomass from within about a 50 mile radius and generates electricity. That plant has contracts with a couple of the universities, I mean, the electrical providers in Arizona to buy that.

One of the problems we've got is that with the decrease in the price of fossil fuels there's a disincentive then to use biomass which now is more expensive, even than solar.

But still as part of a comprehensive package it's important. We're talking about health a few minutes ago. That biomass that's burned in a plant generates very little smoke and other items in smoke that threaten human health. So instead of burning it out in the woods if you can burn it in a facility, a biomass conversion facility, you can solve that problem.

Right now the biomass part of this is a major stumbling block to how we can pay for and do effective landscape scale restoration, more work needs to be done. We've got ecological restoration institutes, state foresters and University of Idaho are working together in February to examine this biomass issue to try to look at innovative ways to do that, both for onsite disposal back in the woods without generating as much smoke and then being able to use it actually for electricity.

Senator FRANKEN. Now I have great interest in that and have.

Ms. Fennell, last May Chief Tidwell testified to this Committee on the interaction wildfire and climate change and has done this a number of times. This is, in a way, I think that climate change,

we have seen a change in the duration of the wildfire season. We have seen the change in the intensity of these fires and the size of these fires. This is now the new normal.

I am supporting Senator Wyden's bill, the Wildfire Disaster Funding Act of 2015 because, and Mr. Chairman I am just going to go a little bit over, if that is okay, just a minute or so.

Senator RISCH. Do I have any choice? [Laughter.]

Senator FRANKEN. Actually, you do.

Senator RISCH. Go ahead.

Senator FRANKEN. Okay, thank you. Thank you for exercising your option to give me the minute or so.

It seems to me that we have so much, that we are doing so much fire borrowing that we should be treating this as the new normal and that is disastrous.

Superstorm Sandy caused about \$60 billion in damage, or at least the cost to Federal Government that this, I think, should be treated as a new normal. I think we should be treating these as disasters, especially these super huge fires, and about 30 percent of the cost comes from that.

So I would just make a plea for Senator Wyden's act which would use 30 percent as a disaster fund and treat it in that way because I think that is what it is.

Thank you. Thank you, Mr. Chairman.

Senator RISCH. Thank you, Senator Franken.

Let me help you out a little bit with your interest in biomass.

This is not new, particularly in Idaho. They have been running at this for over ten years, and they have been notoriously unsuccessful in doing it.

Dr. Covington, rightly pointed out there's additional research going on it. I would disagree a little bit with Dr. Covington in that one of the real challenges is the fumes and smoke and what have you that is put off by the burning of the biomass. Now certainly, it is better in a controlled atmosphere than it is in the woods. But having said that, the EPA would probably disagree a bit with you, Dr. Covington, that this is something that needs additional work because the private companies that have tried to do this have not been successful at it.

There have been some successes but they are very, very limited. The only way, I think, that is it is going to be done, at least under present circumstances, is with subsidies from the Federal Government. I know that does not particularly trouble you, but there are those of us who are not looking down that road very favorably, but—

Senator FRANKEN. May I respond very quickly?

Senator RISCH. Please.

Senator FRANKEN. We have a combined heat and power plant in St. Paul, Minnesota that generates electricity and also does the end, does the heat and cooling for downtown St. Paul. I think they have been successful and that this has been done successfully in other places.

Senator RISCH. That is correct, and in the old days it was very, very common. Every small town in Idaho had a sawmill, and that sawmill had what they called a tepee right next to it. The tepee was a co-gen facility that generated heat and steam and electricity,

and it was very, very, common. Every small town had one. They are all gone.

I don't know, do you guys have tepees left in your states? They are gone from Idaho. But Senator Franken, you were correct. It was very, very common, but because of the cost of it and because of the environmental challenges they have been wiped out. They are gone.

I am not saying it should not continue to be pursued. The University of Idaho is doing some great work in that regard.

Senator FRANKEN. It is a great university.

Senator RISCH. It is. It is my alma mater, I might add. [Laughter.]

As long as we have mentioned that, my undergrad, as most of you know, was in Forest Management. A little over half a century ago I sat in the classroom. I took a couple of semesters of fire behaviors. If it was not the class, it was at least part of the studies in that particular class.

But really, with all due respect, the things I have heard here today and the things I have heard over the many, many hearings we have had on this have really not put anything new on the table. Back then, half a century ago, we were only 53 years from the Big Burn in Idaho. Now we are over a century but back then it was only a half a century ago. The professors who taught, the people who worked in the woods, they all knew the Big Burn and they knew what had happened and they knew how fire behaved and what caused it and what the problems were. So this is not new.

The problem here is not the problems that you, all of you, have described. Those problems have been known for a long, long time. The problem here is very, very political, and I do not mean republican versus democrat. With all due respect to our colleagues that live east of the Mississippi River, they really do not have an understanding of what fire is like in the ecosystem that we live in the West. And with all due respect to Senator Stabenow, who talked about private lands, look, in Idaho two out of every three acres is owned by the Federal Government. We never had a major fire in Idaho that it was not the Federal Government that was in it up to their ears and a lot of it due to poor management.

The Good Neighbor laws or policies Senator Stabenow talked about, the people in Idaho do not particularly look at the Federal Government as a good neighbor when it comes to management of their yard. They do not cleanup their yard, and the result of that is we have major, major catastrophic fires and are sitting on the edge of it.

When I was Governor we had a summer that had particularly bad fires, so I spent a lot of time in an airplane looking at those fires from the air. It was stunning to me. I knew this before this happened and it is not rocket science, but it was stunning what happens when a fire comes up against land that has been treated or even land that has been harvested, just harvested, or and more commonly and we have it in Idaho very commonly, and that is it comes against an area that had been burned within recent years and the fire just stops. It changes, its character changes, everything changes and the fire is much more containable.

So the problem, I guess I am following the camp with Senator Daines, and that is I am just tired of talking about this, you know? We all know what the problem is, and assent of the Crapo/Wyden bill is a really, really important and good response to this. What it does so simply, it tells the Forest Service that you should be using your prevention money for prevention instead of putting the fire out.

If we did that one of you said, and I do not remember who it was, that this whole thing starts right here with this Committee. You are absolutely right. This is where it starts, and we really need to get it done.

Thank you for holding the hearing, again, Madam Chairman. One would hope that at some point in time we are going to be able to move forward on this. So, thank you.

Mr. WYSS. Senator Risch, if I may?

The Chairman [presiding]: Mr. Wyss?

Mr. WYSS. The one thing that is not being discussed in all of this, we're talking about pretreatment and treatments. My job is to do long-term recovery for all the fires that have occurred in our state and around, and it comes with post-treatment as well.

Once the timber has burned and it is still standing, cleaning up the fuel load of the burned timber which if not done will fall and become the next fire, and coming up with options for that including bio-char are significant items that we can look at. Because the market becomes so flooded with the burned timber, we have to find alternative options. And our state is looking significantly at bio-char and other options with that burned timber to get it out of the forest so it doesn't become fire again and fuel for the next fire. So I think we have to look at it not only as pretreatment, but post-treatment as well.

Senator RISCH. Thank you very much, I appreciate it.

Madam Chairman, thanks.

The CHAIRMAN. Thank you, Senator Risch.

There has been a lot of discussion about the need to do more treatment either pre- or post- and I certainly understand that. Of course it does come down, to a certain extent, to the dollars, the resources that are made available. But we also know that we have got some obstacles just in doing that and obtaining the necessary permits. I think Senator Daines was one who mentioned it.

I would throw this out to you, Mr. Maisch, maybe to Chief Burnett or Mr. Wyss as well. In terms of those obstacles that keep us from really carrying out the hazardous fuels reduction program, what is in our way? Is it just a matter of dollars? Are there more politics to it that we need to address? Can you outline some of that for me?

Mr. MAISCH. Yes, I'd be happy to.

I think it is a suite of things. It is, in part, funding but probably the bigger part is at least on Federal lands, as we had some discussion here in the Committee, on the litigation side of this issue.

Do you get at it through some kind of categorical exclusion process that would help with some of that? Do you do programmatic level NEPA that would clear very large projects on a landscape level so there's only one NEPA process and then you implement projects that are covered by that, in that umbrella NEPA project?

So the potential litigants only get one bite at the apple instead of repeated bites every time we do smaller scale projects across the landscape.

I think we have to start thinking in bigger terms and a broader, all hands, all lands. I think you've probably heard that term from previous committees. It's not just the Federal lands. It's the State. It's local jurisdictions.

But we do have to get a handle on that Federal piece, because that's where the road block often is right now.

The CHAIRMAN. Any other comments?

Mr. WYSS. I would concur that in getting a handle on that. We have a DNR section of state land owned in the Carlton Complex fire that was cleared for treatment. NEPA, CEPA were both done, and the DNR was going to clear the burned timber. That is still tied up in litigation, and that timber is now falling to the ground and the wind storms and unable to clean it up or even recover dollars from that. So the litigation piece is a significant challenge to it.

But it's not only litigation. We have another track that's above Highway 20 in between Twist, Washington and Okanogan, Washington where it's a multiple jurisdiction ownership. The BLM has ownership, and the Forest Service has some ownership. Trying to do the necessary treatment, post-fire, has been slowed down because the two agencies do not work together.

They need to streamline that piece to get, I mean, it's all approved. But the BLM and the Forest Service are still having a slight disagreement, so on the best way to manage the removal of the timber. And that's what's causing our challenges of not being able to get this done.

The CHAIRMAN. Ms. Fennell, you have in your report looked at the, just the reviews, the fire reviews and the concerns that we are seeing that we have not been doing the reviews as has been directed. Are some of the things, for instance, that Mr. Wyss just mentioned in terms of the agencies not coordinating well with one another? Is that something that we need to beef up or make sure are included as part of these reviews is what happens after the fire?

Ms. FENNELL. We think that the reviews are a very important way of assessing the effectiveness of their ability to respond to fires and to suppress fires. And we called for, specifically, that they consider specific, clear criteria that they can use to select fires and then to conduct the fires and update their policies accordingly. We think that they can consider a multitude of criteria in selecting those fires and look for reducing how they are going to implement our recommendation to do so.

The CHAIRMAN. This might not be a fair question, but I am going to ask it anyway. Is there one agency—does Forest Service do a better job than BLM or a State? Can you give me an indicator as to whether or not there is one model that might be working better than others or are all of these equally fraught with problems?

Ms. FENNELL. Our work has shown that both Forest Service and Interior could benefit from greater information to make informed decisions. And we've noted in our recent work that both are looking to implement a number of different efforts to improve the way that

they are fighting wildland fire. But there has been a lot of studies that have gone before these particular reports and we still think that they need to target better information in terms of what the large fire reviews have shown, what the performance of different aircraft to fight fires has shown and also better ways to deal with preparedness and effectiveness. So we think there are opportunities for both agencies.

The CHAIRMAN. Well coming from a state where we have got a lot of land that goes up in smoke every year and as a state we feel like we are pretty in tuned with what is going on with fires, and the state is a pretty good example to look to of how you bring all hands in to address threats, not only to communities, property, but just to the land itself.

Are our Federal agencies not synching in sufficiently with our States and our local fire experts here? Is this part of our problem? Chief Burnett, you are smiling.

Mr. BURNETT. You're asking the tough question. I can't tell you why it doesn't happen. I can tell you that it needs to happen and that the benefits are clearly articulated in this panel.

So, you know, Forest Ridge Wildfire Coalition has received grants from the Department of Natural Resources to do fuel modification efforts around there. We coordinate with the State agencies as well as the Federal agencies to do fuel treatments in that prescribed or in that general jurisdiction or geographical area.

We're working well with our partners as far as the restrictions that they have to go through in order to make it happen. You know, that's and it's, I think it's a political issue and a logistic or a litigious concern.

The CHAIRMAN. I appreciate that.

I am going to ask Senator Cantwell to wrap up with the final questions, but I do not want to conclude without a final question to you, Mr. Zerkel, because you have raised the issue of aviation assets and where we are. You have questioned, very clearly, I think, the wisdom of the government-owned tankers and the proposal going forward with these next gen air tankers. You have noted, very clearly, I think, for the record that what we have is not only an inconsistency. You call it a double standard between the government-owned aircraft like the C130Hs and the fact that you have a different standard that is held toward the commercial aircraft that are stepping up.

Do you think that the private air tanker industry can meet the need for 18 to 28 next gen air tankers with the specifications that the Forest Service has called for?

Mr. ZERKEL. Senator, given a specific defined requirement and a specific contractual procedure I have no doubt that industry can meet any requirement that the Forest Service might have for large air tankers.

We have a large amount of experience. The industry has been at it for an awful long time, but the problem in the past has been a mixture and an undefined set of qualifications that industry faces. We're not going to spend a whole lot of capital if we don't know exactly what it is the Forest Service requires and for how long they require it.

The CHAIRMAN. So you would not only need specific criteria for standards, although you are saying look, we just go by the FAA standards. You also need some definition in terms of how long that commitment from Forest Service would be to whether it is Lynden or other operators that would provide such aircraft.

Mr. ZERKEL. That's correct for the industry at large.

First of all the range of tankers that they think they require. The 18 to 28 is a little difficult for industry to comprehend. Is it 18? Is it 20? Is it 25? Is it 40, which it was before 2002. So that's what I mean by defined set of requirements in terms of the numbers of large air tankers and then clear, concise contracting procedures.

The CHAIRMAN. Just for the record, you had indicated you had stepped up to make the build out for your Hercules so it could meet the requirements that had been set forth by Forest Service, but because of tight timeframes, you were not accepted into that pool of eligible aircraft for contracting. What does it cost to basically outfit an aircraft to meet these standards in terms of investment that you made to prepare for this what was the commitment there? Because I understand now this aircraft is not even being used here in the country, and it is being used for fire fighting in Australia, I think you said?

Mr. ZERKEL. That's correct.

Lynden spent about \$4.5 million in the procurement of a retardant tank drop system, the installation and the training of our personnel to bid for that next gen 2.0 contract. We were not successful in the bid and maybe rightfully so because of one portion of our supplemental type certificate was incomplete. We accepted that. We're going to fix that, and we are going to bid at the next opportunity. But the point is that we have those requirements, all of industry, not just Lynden, not just any of the other ones.

The Forest Service, under this program, the public format program, would not have that. They could basically do whatever they wanted to do. Now I'm not saying they wouldn't do a good job or the Coast Guard or a vendor or whatever that they get to do it wouldn't do a good job. But the fact is they don't have to whereas the rest of industry does. And it's—

The CHAIRMAN. So it is—

Mr. ZERKEL. Yes.

The CHAIRMAN. A different standard.

Mr. ZERKEL. Absolutely.

The CHAIRMAN. Thank you.

Senator Cantwell?

Senator CANTWELL. Thank you, Madam Chairman.

I wanted to go back Chief Burnett and Mr. Wyss about the after effects because we are talking a lot here about obviously the economic loss of timber lands. But I am not sure we have given everybody a clear picture of how long it takes to recover. And one thing I mentioned earlier, the \$300,000 from the Forest Service to help restore the impacts from the Wolverine fire—but can we talk about where we are one year after the Carlton Complex?

Mr. WYSS. Sure.

Senator CANTWELL. And what we need to do and what happens when the money runs out? What happens? Chief Burnett, if you wanted to comment on that as well.

Mr. WYSS. Okay.

So one year after the Carlton Complex, I mean, we had \$100 million worth of damage in a community and a county that's the 13th largest county in the United States and 39,000 people. So 39,000 people are trying to dig out of \$100 million hole.

It makes it challenging when you lose 500 structures. Our community took a significant financial impact to the loss of value. 20 percent of our school district value is gone, 20 percent of our hospital district value is gone, and that drives significant cost factors.

When you lose 50 people out of the community in Pateros because 34 homes burned inside the city limits, you no longer have people paying into the water system and the water fees go up double because there's less people paying into the system and it has to be repaired.

Our communities, our small businesses, when including in Chelan this year with the Wolverine fire in Chelan and the Reach fire, for 10 days were closed, completely. Our small businesses paid the credit card impact fees for the reservation in and the reservation out which are non-reimbursable.

The communities and the small businesses who rely on tourism lost \$1 million a day in the Winthrop and Twist area and \$2.5 million in Chelan because the tourists were not allowed to come in because we were under immediate evacuations.

When you look at the forestry and timber, the value of timber has dropped in half because the timber that was marketable burned and now there's limited market. When you burn 200,000 acres last year and then 500,000 acres this year and then millions of acres in Alaska, the timber market starts to get pretty flooded with burned timber and you have to get that off within a short period of time before it blue stains.

Then you look at our reservations where, you know, they're going to face 20 to 25 percent of their budget comes from timber and a billion dollar hole comes over a span. So our long-term recovery efforts are going to be 10 to 15 years in our small community to try to recover.

For the rebuilding of homes and construction, only 40 people qualified, who were the most needy of needy to have homes rebuilt by volunteers through the VOAD partners and the national VOAD partners in donations. So we have 11 of those homes completed and done, and we were thinking we were on the upward trend when this fire hit and we lost 100 more homes.

So back-to-back impacts have really hit our economy hard, our budgets hard, our roads, our transportation and infrastructure, but not only that, we're going to suffer ramifications of unintended consequences with flood. We actually washed out a highway with just one inch of rain this last year because the trees couldn't absorb it, and we'll have it again this year with floods and snow pack.

And we have 10,000 wildlife without a place to eat because we've burned all their habitat which then goes, Senator Stabenow talked about agriculture and Senator Cantwell you know we have the best apples and cherries in the world in our state. Well those deer eating the limbs and the buds off the trees which are impacting the agriculturalist's future because they don't have anything to eat.

So our ramifications and long-term impacts are going to be felt for a number of years, and it's going to cause some of our folks to lose their businesses, their farms and ranches. And we will recover. I mean, that is my job as the lead recovery efforts, and we will do it. But we will come out of it stronger, more efficient and better.

We just thank you, Senator Cantwell and Senator Murkowski, for holding these hearings to bring these issues to the forefront.

Senator CANTWELL. Mr. Burnett, did you want to say anything about, you had a concern about logs, potentially, you know, more trees falling and potentially putting more at risk in the future?

Mr. BURNETT. Right.

As Jon was speaking that there is a lot of timber that's harvested afterwards. But back to the competing interests of how to best deal with the wildfires and post-wildfires there's a lot of logs that are not, a lot of standing timber, that is not allowed to be logged post-fire. And it creates a significant danger with hazard trees. We've lost many wildland firefighters from tree hazards.

The burn scars area that we look at for trying to catch a fire, as an incident management team we'll look out ahead for any kind of natural barriers or manmade barriers. The natural barriers are, you know, rocks, trees, rivers or previous fire scars. If those previous fire scars are left untreated that is a hazard area that we can't send our fire fighters into in order to gain access to other areas or to fight the fire in that area.

Senator CANTWELL. Well Madam Chairman, thank you for this hearing. I want to thank all the witnesses, and obviously each of you have been dealing with this from one or more facets so we thank you for that.

That is why, Madam Chairman, I want to work with you and see what we can do to move forward.

I think the thing that might be different than some of the discussions that we have had before is the fact that, as Mr. Wyss said, the economic impacts here are something that we are going to feel for a long time. I think the threat that we see coming at us, that these are not the two worst years we are going to see, that the worst is still yet to come, I think demands us to think in new ways and figure out how to better prepare our nation for the economic, incredible economic, damage and loss that is going to occur and figure out a strategy for prevention and preparedness.

So I look forward to working with you on that.

The CHAIRMAN. Thank you, Senator Cantwell, and know that we both agree we have got a lot of work to do. I do think that we gained some good insight from the panel this morning and from the questions that were raised by other colleagues.

You speak to the economic damage and the economic impact, post-disaster, post-fire, and you clearly have seen that in your state. Typically in Alaska we will see more acreage burned and very little lost in terms of property value. This year was different losing 55 homes in and around the south central area.

I think that causes us to recognize that when we think about the economic impact, the loss, not only from a financial, but really from an emotional perspective is something that we need to be very, very cognizant of, but we also then need to be very wise, very smart and very strategic in how we manage these fires and finding

these levels of efficiency because, as you and I both know, the Federal dollars here are not getting that much more generous.

I know in my state we have made dramatic reductions in our state's budget this year which further restricts the ability of our state to be engaged. We need to be smart in how we are managing this, so to hear that we have assets that are either being held back or are somehow or other just not being as efficient as we need them to be, when you have agencies that are not coordinating, when you have differing standards, when you have inefficiencies that are built into this system, that is something that we can control.

You and I cannot stop that fire today, but we can make sure that as we are dealing with these fires we are working smart and we are working efficiently and collaboratively.

So I look forward to working with you and all of you.

We appreciate the time this morning.

Thank you.

[Whereupon, at 12:16 p.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

Response to Post-Hearing Questions for the Record
"Future Federal Wildland Fire Management Strategies"
Committee on Energy and Natural Resources
U.S. Senate
Hearing held November 17, 2015

Questions for Anne-Marie Fennell, Director
Natural Resources and Environment
U.S. Government Accountability Office

1. What actions, if any, has GAO seen the Forest Service and DOI agencies take to prioritize hazardous fuel reduction funding to the areas of the country with the greatest need and risk of wildfires?

GAO Response: Since our 2007 report highlighting the need for improved approaches to prioritizing fuel reduction funding, the agencies have developed several fuel reduction funding distribution tools. In our September 2007 report, we recommended that the agencies develop a systematic approach to allocating fuel reduction funding.¹ Beginning in 2009, the Forest Service and Interior both used systems collectively known as the Hazardous Fuels Prioritization and Allocation System (HFPAS) to distribute fuel reduction funds. Officials from both agencies told us these systems were developed to provide an interagency process for distributing fuel reduction funding to the highest-priority projects. According to Forest Service officials, however, in some cases HFPAS prioritized funding for areas where important resources existed but where the potential for wildland fires was low. Starting in 2014, the Forest Service instead began using a new system, which, according to officials, allows the agency to more effectively distribute fuel reduction funds based on areas where the highest probability of wildland fire intersects with important resources, such as residential areas and watersheds critical to municipal water supplies.

Interior continues to distribute fuel reduction funding to its four agencies responsible for wildland fire management—the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service—based on funding amounts derived from HFPAS, using results last generated in 2013. Officials told us, however, that Interior plans to develop a new system for distributing funds to reflect more current conditions and risks. Interior documents state that the new proposed model will assess the probability and likely intensity of wildland fire, the values at risk from fire, and the expected value of acres likely to burn. Until the model is developed, each Interior agency is relying on its own approach to distribute fuel reduction funding. For example, the Bureau of Land Management has created a tool that, similar to the Forest Service, accounts for both the highest probability of wildland fire and the presence of important resources.

¹GAO, *Wildland Fire Management: Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuel Reduction Funds and Selecting Projects*, GAO-07-1168 (Washington, D.C.: Sept. 28, 2007).

2. Currently, how do these agencies allocate funds to the field for hazardous fuel reduction?

GAO Response: As detailed in our September 2015 report,² Forest Service officials told us their new system identifies locations where the highest probability of wildland fire intersects with important resources, such as residential areas and watersheds critical to municipal water supplies. These officials told us the new system allows the agency to invest its fuel reduction funds in areas having both a high probability of wildland fires and important resources at risk. In contrast, according to officials, HFPAS in some cases prioritized funding for areas where important resources existed but where the potential for wildland fires was low. The new system has also identified locations for funding adjustments to Forest Service regions. For example, in 2015, the agency's Eastern and Southern Regions received a smaller proportion of fuel reduction funding than they had previously received. In contrast, some western regions saw increases, because results from the system showed that the western regions had more areas with both important resources and high wildland fire potential.

Interior continues to distribute fuel reduction funding to its four agencies using HFPAS results that were last generated in 2013. Within Interior, officials from the four agencies told us they have developed, or are in the process of developing, funding distribution systems and tools while they wait for Interior to complete its new system for distributing funds. The Bureau of Land Management, for example, uses a fuel reduction funding distribution tool that maps values at risk, including critical infrastructure, sagebrush habitat, and invasive species data. It combines this information with data on wildland fire probability to create a spatial illustration of the values at risk relative to potential fire occurrence, and then use the results of this analysis to fund its state offices. The Bureau of Indian Affairs uses its own tool to distribute fuel reduction funding to its regions based on wildland fire potential data, combined with fire occurrence history and workload capacity, to generate a model that shows potential fire risk and capacity across its units. Officials from the Fish and Wildlife Service told us they are developing a fuel reduction funding distribution tool, expected to be used for fiscal year 2016, which considers fire risks associated with each unit. Officials from the National Park Service told us the agency uses an approach that relies on historical amounts, based largely on HFPAS, under which it distributes funding for specific projects identified at the headquarters level.

3. One of the areas GAO reviewed in this latest report was whether agencies were conducting post-fire reviews. Are the Forest Service and the DOI agencies conducting post-fire reviews consistent with Congressional direction and agency policy?

GAO Response: As detailed in our September 2015 report, the Forest Service and Interior agencies have conducted reviews to assess their effectiveness in responding to wildland fires, but have not consistently followed agency policy in doing so. For fiscal years 2003 through 2010, congressional committee reports directed the Forest Service and Interior to conduct reviews of large fire incidents. Beginning in fiscal year 2006, these reports included a cost threshold, specifying that such reviews be conducted for fires involving federal expenditures of \$10 million or more. The agencies, in turn, have each developed their own policies that generally direct them to review each fire that exceeds the \$10 million threshold. The agencies have not consistently conducted reviews meeting the \$10 million threshold, in part because, according to officials, doing so does not reflect the agencies' focus on assessing the

²GAO, *Wildland Fire Management: Agencies Have Made Several Key Changes but Could Benefit from More Information about Effectiveness*, GAO-15-772 (Washington, D.C.: Sept. 16, 2015).

effectiveness of their response to fire. For example, Forest Service officials told us that focusing exclusively on suppression costs when selecting fires limits the agency in choosing those fires where it can obtain important information and best assess management actions and ensure they are appropriate, risk-based and effective. Forest Service officials acknowledged the need to develop more specific criteria for selecting fires to review, and in July 2015 told us they are working to update their criteria for doing so.

Within Interior, Bureau of Land Management officials told us the agency completed its last fire review based on the \$10 million threshold in 2013. These officials told us that the agency, similar to the Forest Service, plans to shift the emphasis of its reviews to evaluate management actions rather than focusing on cost, and both are working to determine criteria for selecting fires for review. Interior headquarters officials told us that the Fish and Wildlife Service and National Park Service have continued to follow the direction provided through their policies regarding reviews that met the \$10 million threshold. However, these officials acknowledged the need to improve Interior's approach to selecting fires for review, and in July 2015, told us they plan to develop new criteria for use by all Interior agencies in selecting fires to review and expected the effort to be completed by the end of calendar year 2015. Since that time, however, Interior officials told us they expected the effort to extend beyond calendar year 2015.

4. Currently, what criteria do the Forest Service and the DOI agencies use to select fires for post-fire reviews? What do the Forest service and the DOI agencies look at in a post-fire review? What do they do with the information gathered in a post fire review?

GAO Response: As noted in our September 2015 report, Forest Service and Interior officials told us they are working to improve their criteria for selecting fires to review. Forest Service officials told us the agency judgmentally selects incidents to review based on a range of broad criteria, such as complexity and national significance, taking into account political, social, natural resource, or policy concerns. Using these broad selection criteria, the Forest Service reviewed 5 wildland fire that occurred in 2012 and 10 that occurred in 2013.³ We found, however, that given these broad criteria, it is not clear why the Forest Service selected those particular fires to review, and not others.

In conducting the reviews for those 2 years, the Forest Service did not use consistent or specific criteria. In both 2012 and 2013, the reviews included four common objectives, which were to identify (1) best business practices used on fires the past fire season, (2) how social and political issues factored into agency decision making, (3) which current procedures can be enhanced or expanded, and (4) improvements that can be made in sharing and clarifying expectations. In 2013, the reviews included two additional objectives: (1) examine actions taken by the incident management team and the local agency administrator to meet the direction provided by the Forest Service Chief,⁴ and (2) assess the consideration and effectiveness of applying risk management concepts to incident cost through the associated decisions and expenditures as an outcome. A 2013 report assessing the usefulness of the Forest Service's five reviews of 2012 fires noted shortcomings in consistency across the reviews, including

³As of July 2015, the Forest Service had not selected fires to review from the 2014 wildland fire season.

⁴Incident management teams are specialized teams mobilized to respond to wildland fires, with the size and composition of the team determined by the complexity of the fire. The agency administrator is generally the official in charge of a field unit, such as a national forest supervisor or national park superintendent, having responsibility for managing the fire. These officials must approve major decisions that incident management teams make during a fire response.

unclear criteria for selecting fires and conducting reviews, as well as limitations in the specificity of the resulting reports and recommendations.⁵

In the most recent review done by the Interior agencies—BLM's review of a 2013 fire in Alaska—the review objectives included, among others, examining (1) the strategic decisions made on the fire with respect to relevant land management plans, (2) whether appropriate line officers were involved in financial oversight and strategic decisions, (3) whether cost-saving actions were effectively implemented on the incident, and (4) costs as they related to fire suppression strategies and tactics, social and political issues, and the effective use of personnel, equipment, and aircraft. In November 2015, Interior officials reported that Interior is completing an analysis of Large Fire Cost Reviews from 2007 to 2014, and that it will share the findings and recommendations from that analysis with the Interior Fire Executive Council. The Council is then to advise Interior regarding specific criteria for use in reviewing wildland fires.

We did not review the agencies' use of information provided through the completed fire reviews.

5. **Your written testimony states that “changing climate conditions... have increased the length and severity of wildfire seasons, according to many scientists and researchers.” Could you describe the scientific evidence regarding the link between human-caused climate change and wildfire risks?**

GAO Response: As described in our September 2015 report, according to the U.S. Global Change Research Program's 2014 National Climate Assessment, projected climate changes suggest that western forests in the United States will be increasingly affected by large and intense fires that occur more frequently.⁶ According to the 2014 Assessment, climate change is increasing the vulnerability of many forests to ecosystem changes and tree mortality through fire, insect infestations, drought, and disease outbreaks. The 2014 Assessment also stated that in some regions, prolonged periods of high temperatures associated with droughts contribute to conditions that lead to larger wildfires and longer fire seasons. The increasing prevalence of extreme conditions that encourage wildfires can convert some forests to shrublands and meadows or permanently reduce the amount of carbon stored in existing forests if fires occur more frequently, according to the 2014 Assessment.

We also noted in our 2015 report that changing climate conditions, including drier conditions in certain parts of the country, have increased the length and severity of wildfire seasons, according to many scientists and researchers. For example, in the western United States, the average number of days in the fire season has increased from approximately 200 in 1980 to approximately 300 in 2013, according to the *2014 Quadrennial Fire Review*. In Texas and Oklahoma this increase was even greater, with the average fire season increasing from fewer than 100 days to more than 300 during this time.

⁵Wildland Fire Lessons Learned Center, *Lessons From Recent Large Fire Reviews: Briefing Paper* (August 7, 2013). There was no similar analysis performed of the Forest Service's 10 reviews of fires occurring in 2013.

⁶Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, eds., *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program (Washington, D.C.: U.S. Government Printing Office, 2014). The U.S. Global Change Research Program coordinates and integrates federal research on changes in the global environment and their implications for society. The 13 federal agencies that participate in the program are the Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Interior, State, and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; the National Science Foundation; the Smithsonian Institution; and the U.S. Agency for International Development.

6. **Looking forward, what does the scientific research indicate about what a changing climate will mean for wildfire damage in future decades?**

GAO Response: According to the United States Global Change Research Program's May 2014 National Climate Assessment, given strong relationships between climate and fire, projected climate changes suggest that western forests in the United States—even when modified by land use and management activities, such as fuel treatments—will be increasingly affected by large and intense fires that occur more frequently. Eastern forests, according to the Assessment, are less likely to experience immediate increases in wildfire, unless a point is reached at which rising temperatures combine with seasonal dry periods, more protracted drought, and/or insect outbreaks to trigger wildfires.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

Complete references cited in these responses can be found at the end of responses.

Questions from Chairman Lisa Murkowski

Question 1: Recognizing that budget constraints exist and that we cannot treat every acre, what does an effective fuels management program, in your view, look like?

An effective fuels management program in frequent-fire forest types requires several elements:

1. Treatments should be effective at restoring forest health and resiliency (Covington et al. 1994). To the extent practicable, and understanding that treatments must comply with federal laws and regulations, it is ecologically and economically most effective to use *restoration-based* approaches to reduce excess fuels—not single objective treatments that are only focused on reducing hazardous fuels. Restoration-based treatments will reduce tree densities to within scientifically established levels and will emulate forest pattern and composition and restore self-regulatory processes (Covington et al. 1999). Using a restoration approach will concurrently enhance and protect other resource values such as wildlife habitat, watershed function, and recreational values, while restoring self-regulatory mechanisms important for adaptation to climate change. This approach also increases the long-term effectiveness of treatments and enables low-cost maintenance through the use of prescribed fire, therefore improving the economic return on investment (Ecological Restoration Institute 2013)
2. Treatments should be strategically placed to reduce the risk of mega fire (see question 2).
3. Treatments should be prioritized to protect values at risk (see question 3).

Question 2: Where should fuel reduction treatments occur to reduce the size and severity of expensive megafires? Why?

Federal lands are managed to meet multiple objectives. In response to increased large fire in the Southwest, however, the ERI conducted scenario analysis research (Waltz 2012) to evaluate the effectiveness of the United States Forest Service (USFS) fuel reduction priorities based on fire hazard alone, as modeled by potential to crown, or burn, through tree tops. We examined the half-million acre landscape burned in the 2011 Wallow Fire in eastern Arizona. The goal was to determine what the outcomes of a Wallow-like fire would have been had forest treatments been conducted on all high hazard areas, if implemented prior to 2011. High fire hazard areas were mapped in wildland-urban interfaces (WUIs), the greater landscape outside of the WUI, and wilderness areas based on pre-Wallow conditions. Treatments were simulated in the WUI areas and in the entire landscape. The simulated modeling results showed that:

- Simulated treatments implemented only in WUI areas reduced the modeled potential active crown fire threat by 12% and reduced flame lengths by 6%.
- Treatment simulations run on all high fire hazard areas resulted in an active crown fire reduction of 40% and flame lengths by 30%.
- WUI-only treatments result in losses in ecological integrity across the landscape because high fuel loadings, which lead to uncharacteristically high fire severities and intensities, continue over the broader landscape.

In summary, in order to reduce the size and severity of mega fire, treatments are needed outside the WUI. Treating only in the WUI will not prevent megafires. Caveat: public lands are not managed for one goal

U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington

(e.g., to reduce size and severity of mega fires) and have limitations on treatment opportunities dependent on management designation and other uses.

Question 3: In your opinion, how should the Forest Service and DOI agencies prioritize their hazardous fuels reduction program funds to maximize the benefit in creating resilient forests and reduce the risk of megafires?

The federal research labs, including the USFS Research Stations, Interagency Fire Labs, and Threat Assessment Centers, have developed tools and spatial products to identify and categorize risk of fire with other priorities to best inform federal allocation of fuels reduction treatments to protect values and resources (summarized in Dillon et al. 2015, additional references listed below, and see <http://www.forestsandrangelands.gov/strategy/index.shtml>).

In addition, a 2013 Ecological Restoration Institute report by Crouse and Waltz described methods to identify treatment priority areas to meet dry-forest restoration goals across the Apache-Sitgreaves National Forests in eastern Arizona. In historically frequent-fire forests, like ponderosa pine, restoration strategies and priorities can reduce large-scale, uncharacteristically severe wildfire. In these systems, the report recommends using variables such as vegetation type and structure, topography, land-use designation, watershed health, and WUI to prioritize treatment area as follows:

- WUI areas at risk of fire.
- Frequent-fire forest types that have had fire exclusion and demonstrate structural alterations resulting in stands that are more dense than historically found.
- Watersheds that have been determined to be functioning at risk or having impaired function might be considered priority treatment areas.
- Slopes that are operationally feasible for restoration thinning (the slope limitations vary by forest and region depending on available industry and other management designations).
- It is critical to note that existing land-use designations may limit where treatments can be conducted (see report).

Question 4: The Forest Service and the DOI agencies talk about managing some wildland fires for resource benefits. In your experience can wildfires be managed for resource benefits? What resource benefits are there to allowing a wildfire to burn?

Reported benefits from the literature:

- Reduce surface fuels (Larson et al. 2013)
- Reduce canopy fuel loads (Hunter et al. 2011)
- Reduce potential fire behavior and subsequent burn severity (Hunter et al. 2011, Parks et al. 2013)
- Reduce tree density (Fulé and Laughlin 2007, Taylor 2010, Hunter et al. 2011, Larson et al. 2013)
- Reduce stand basal area (Hunter et al. 2011)
- Reduce density of fire-intolerant tree species (Fulé and Laughlin 2007)

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

Conditions and limitations:

- Studies are commonly limited to individual fires or wilderness landscapes.
- Benefits are found to be related to burn severity; there are limited benefits to areas that burn with too low or too high severity fire (Hunter et al. 2011, ERI *unpublished data*).
 - Areas burned in low severity fire can still have high stand density and fuel loading (Hunter et al. 2011, ERI *unpublished data*)
 - Areas burned in high severity fire can result in a vegetation type conversion and ecological deterioration (van Wagtenonk et al. 2012).
- Fires can change understory plant community composition, but effects on plant abundance and species richness (the number of different species) is uncertain (Laughlin and Fulé 2008).
- First-entry fires on general-use forested public lands can be dominated by low severity areas that show little benefit at reducing fuels or tree densities (ERI *unpublished data*).
- First-entry fires can produce a regeneration pulse, which may lead to vegetation type conversion or continued poor ecological condition (Taylor 2010, Larson et al. 2013).
- Multiple entries with fire have variable results: In some cases severity in areas previously burned by resource benefit fires is lower than the initial (first-entry) burns. In other cases, burn severity is higher with repeated entry and this can lead to an increase in high-severity areas and decreased ecological integrity (Hunter et al. 2011, van Wagtenonk et al. 2012, Larson et al. 2013).
- Effects of wildland fire management on old trees are not well studied (but see Taylor 2010).
 - Thinning small trees has been reported, which could increase the health of old trees (Fulé and Laughlin 2007, Taylor 2010, Larson et al. 2013).
 - However, mortality of old trees has also been reported in managed fires (Taylor 2010).
- Effects on tree and stand spatial patterns and relationships to ecosystem health are uncertain (but see Taylor 2010).
- Effects on landscape structure and relationship to ecosystem health are uncertain.

Questions from Senator John Barrasso

Question 1: Across the West, there is a particularly devastating one-two punch destroying sage-grouse habitat. When rangeland fire destroys sagebrush habitat for sage grouse, quick moving invasive species such as cheatgrass dominate the landscape before sagebrush can return. Cheatgrass creates a lack of biodiversity and increases the risk of future catastrophic wildfire damage. This cycle creates a downward spiral where both rangeland fire and invasive species fuel the loss of sage-grouse habitat.

In your experience, how big of a role do invasive species play when considering future wildfire risks?

- The scope of the invasive problem in some areas is on a scale unprecedented since the last ice age and is likely to continue to worsen as invasive species continue to spread and fires in some invaded ecosystems become more frequent (Betancourt 2015).
- The invasion of many western ecosystems, including deserts, grasslands, and shrublands, by invasive plant species, particularly non-native annual grasses such as cheatgrass (*Bromus tectorum*) and medusahead-rye (*Taeniatherum caput-medusae*), is well-researched and documented (Brooks et al. 2004, Zouhar et al. 2008, Pierson et al. 2011). At the landscape level, wildfire frequency and magnitude have increased due to invasive annual grasses, particularly following disturbance (Coates et al. 2015).

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

- Many of these alterations can lead to new and novel fire regimes and ecosystems. Difficulties in management occur when novel ecosystems, never before seen, arise following changes in ecological patterns and processes (including species invasions) (Williams and Jackson 2007).
- Interactions between wildfire, drought, and invasive annual grasses can drive shifts in ecosystem structure and function and change fire regimes, resulting in habitat fragmentation, habitat degradation, increased probability of fire, lengthening of the fire season and loss of plant communities (Brooks et al. 2004, Davies and Nafus 2013, Betancourt 2015, Brooks et al. 2015), and loss of wildlife species diversity, including losses to greater sage grouse (*Centrocercus urophasianus*), and species such as black-tailed jackrabbit (*Lepus californicus*) and Paiute ground squirrel (*Spermophilus mollis*), which are key prey for golden eagles (*Aquila chrysaetos*) and prairie falcons (*Falco mexicanus*) (Knick et al. 2003).

Question 2: In May the Energy and Natural Resources Committee held a wildland fire hearing. During the hearing, one of the witnesses, Mr. Bob Eiscle, a retired Watershed and Fire Analyst witness spoke about his concern with the amount of time needed to complete the Santa Ana Watershed Environmental Impact Statement. In his testimony he stated that “*to do nothing is to doom the forest to a stand replacement fire.*”

In your view, if we do not complete environmental reviews for needed treatment activities in a more timely fashion and on a larger scaler, are we indeed dooming our forests to more megafires?

Conducting NEPA at the scale of the problem (in the case of megafire, at the scale of 100,000 acres or more) is one approach for accelerating landscape scale restoration to address mega fires. The recent completion of the first Environmental Impact Statement (EIS) for the Four Forest Restoration Initiative (4FRI) in Arizona proves that the NEPA process can successfully analyze one million acres of forest. The final Record of Decision for that assessment was signed in April 2015 and clears almost 600,000 acres for treatment (USDA Forest Service 2015).

Accelerating the time line for completion of the environmental review process is possible with adequate human and financial resources. Another factor that influences our ability to solve the problem of mega fire is to prioritize and strategically place treatments where they are most effective (see questions 2 and 3 answered in response to Senator Murkowski).

Questions from Senator Elizabeth Warren

Nationwide, 9.8 million acres of land have already burned in the 2015 fire season, making it one of the most devastating years on record. And although specific numbers can fluctuate dramatically from year to year, the long-term trend is clear — wildfires are becoming more frequent and more dangerous. Since 1980, the typical fire season in the West has grown by about 100 days. Fires of every size on western federal lands are more common than they were in the 1980s, with fires of more than 25,000 acres exhibiting the biggest change; they are now more than three times as frequent as they were just three decades ago.

There is no one factor that completely explains all of this increase. But given the scientific consensus that anthropogenic climate change is exacerbating the risks of extreme weather, it is important that we fully understand the connection between climate change and wildfires.

U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington

Question 1: Your written testimony states that “research shows that... climate change is influencing the frequency and size of fires.” Could you describe the scientific evidence regarding the link between human-caused climate change and wildfire risks?

Research has shown that the observed increase in frequency and severity of drought and wildfire are interrelated and numerous studies have directly linked these increases in frequency and severity of disturbance to climate change (Grissino-Mayer and Swetnam 2000, Westerling et al. 2006, Allen et al. 2010, Williams et al. 2010, Williams et al. 2014a, Williams et al. 2014b). Scientists attribute extreme fire behavior principally to regional and localized fire weather (McKenzie et al. 2004). Specific examples of studies suggesting that climate change is already affecting wildfire frequency and severity include:

- Westerling et al. (2006) showed that wildland fire activity in the western U.S. has recently increased and documented increases in large uncharacteristic fire frequency, longer fire durations, and longer fire seasons.
- Across Forest Service lands in the Sierra Nevada and the southern Cascade Mountains in California and Nevada, Miller et al. (2009) found that the area burned annually, the size of the fires, and the extent of high severity stand-replacing fires had increased noticeably since the 1980s.
- In Yosemite National Park, Lutz et al. (2009) found that the average annual area burned by lightning-ignited fires since the 1980s had double compared to the prior decade.

Without restoration based fuel reduction, as climate continues to shift toward more arid conditions in the southwestern U.S. (Williams et al. 2010, Kunkel et al. 2013, Garfin et al. 2014), existing frequent-fire forested ecosystems are projected to undergo large contractions and potential transitions to woodland and/or grassland ecosystems, and degraded ecosystem structure and function (Covington et al. 1994, Allen and Brunshears 1998, Rehfeldt et al. 2009, Laughlin et al. 2011, Bagdon and Huang 2014, Stoddard et al. 2015) contributing to an overall net loss (when combined with loss due to disturbances) of forested ecosystems.

Question 2: Looking forward, what does the scientific research indicate about what a changing climate will mean for wildfire damage in future decades?

- Globally, increasing temperature and more extreme fire weather is projected to drive future fire regimes. Temperatures exponentially influence atmospheric evaporation demands; as temperatures go up, the atmosphere takes up more water, thereby the system gets drier. The number of large fires is correlated with warmer temperatures and earlier spring snowmelt (Pechony and Shindell 2010, Williams et al. 2012, Westerling et al. 2006).
- The number of large wildfires in the western U.S. has been increasing since the mid-1980s. Eighty-four fires greater than 100,000 acres have been reported since 2005. 2015 is second only to 2006 for the number of acres burned (Westerling et al. 2006, more at <http://www.nifc.gov/fireInfo/nfi.htm>).
- The National Research Council estimated that each degree Celsius of additional warming will increase the area burned by 200–400% in parts of the western U.S. According to Janos Pasztor, United Nations Assistant Secretary-General on Climate Change, the commitments made to date still equate to a projected 3 degrees C increase in mean global temperature by the year 2100. (<http://www.nationalacademies.org/includes/StabilizationTargetsFinal.pdf>)
- Anticipated post-wildfire forest trajectories concluded that severe climate change may lead to non-forest conditions, loss of critical habitat and loss of water quality and supply (Covington et al. 1994, Azpeleta et al. 2014, Brusca et al. 2013, Smith et al. 2011).

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

References and additional information:

Senator Murkowski Question 1

- Covington, W.W., Everett, R.L., Steele, R., Irwin, L.L., Daer, T.A., and Allen, N.D. 1994. Historical and Anticipated Changes in Forest Ecosystems of the Inland West of the United States. *Journal of Sustainable Forestry*, 2:13-63.
- Covington, W.W., Niering, W.A., Starkey, E., and Walker, J. 1999. Ecosystem Restoration and Management: Scientific Principles and Concepts. Pp. 599-617 in R.C. Szaro, N.C. Johnson, W.T. Sexton, and A.J. Malk (eds.). *Ecological Stewardship: A common reference for ecosystem management*. Volume II. *Elsevier Science*. Oxford, U.K., 741 p.
- Ecological Restoration Institute. 2013. The efficacy of hazardous fuel treatments: A rapid assessment of the economic and ecologic consequences of alternative hazardous fuel treatments: A summary document for policy makers. Northern Arizona University. 28 pp.

Senator Murkowski Question 2

- Crouse, J., and A.E.M. Waltz. 2013. Identifying priority treatment areas across the Apache-Sitgreaves National Forests. Ecological Restoration Institute Report. www.nau.edu/eri/library.
- Waltz, A.E.M. 2012. Impacts of fire hazard assessment and fuel reduction priorities on mega-fire outcomes. Ecological Restoration Institute Fact Sheet. www.nau.edu/eri/library

Senator Murkowski Question 3

- Ager, A.A., Valliant, N.M., and Finney, M.A. 2010. A comparison of landscape fuel treatment strategies to mitigate wildland fire risk in the urban interface and preserve old forest structure. *Forest Ecology and Management*, 259(8), 1556-1570. doi:10.1016/j.foreco.2010.01.032
- Calkin, D.E., Ager, A.A., and Gilbertson-Day, J. 2010. *Wildfire risk and hazard: Procedures for the first approximation*. (General Technical Report No. GTR-RMRS-235). Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Cochrane, M.A., Moran, C.J., Wimberly, M.C., Baer, A.D., Finney, M.A., Bechendorf, K.L., . . . Zhu, Z. 2012. Estimation of wildfire size and risk changes due to fuels treatments. *International Journal of Wildland Fire*, doi:10.1071/WF11079
- Dillon, G.K., Menakis, J., and Fay, F. 2015. Wildland Fire Potential: A tool for assessing wildfire risk and fuels management needs. USDA FS Proceedings RMRS-P-73.
- Jones, J.G., Chung, W., Scielstad, C., Sullivan, J., and Krueger, K. 2010. *Optimizing spatial and temporal treatments to maintain effective fire and non-fire fuels treatments at landscape scales*. (Final Report, Joint Fire Science Program No. JFSP Project 06-3-3-14). Washington, D.C.: U.S. U.S. Department of Agriculture/U.S. Department of the Interior, Joint Fire Science Program.
- Stephens, S.L., McIver, J.D., Boerner, E.J., Fettig, C.J., Fontaine, J.B., Hartsough, B.R., . . . Schwilk, D. W. 2012. The effects of forest fuel-reduction treatments in the United States. *Bioscience*, 62(6), 549.
- Syphard, A.D., Scheller, R.M., Ward, B.C., Spencer, W.D., and Strittholt, J.R. 2011. Simulating landscape-scale effects of fuels treatments in the Sierra Nevada, California, USA. *International Journal of Wildland Fire*, 20, 364-383. doi:10.1071/WF09125
- Thompson, C.M., Zielinski, W.J., and Purcell, K.L. 2011. Evaluating management risks using landscape trajectory analysis: A case study of California fisher. *Journal of Wildlife Management*, 75(5), 1164-1176. doi:10.1002/jwmg.159
- Thompson, M.P., Calkin, D.E., Ager, A.A., and Gilbertson-Day, J.W. 2011. Advancing effects analysis for integrated, large-scale wildfire risk assessment. *Environmental Monitoring and Assessment*, 179, 217-239.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

Senator Murkowski Question 4

- ERI (Ecological Restoration Institute). *Unpublished data*. On file at Northern Arizona University, Flagstaff.
- Fulé, P.Z., Laughlin, D.C. 2007. Wildland fire effects on forest structure over an altitudinal gradient, Grand Canyon National Park, USA. *Journal of Applied Ecology*, 44:136-146.
- Hunter, M.E., Iniguez, J.M., Lentile, L.B. 2011. Short- and long-term effects on fuels, forest structure, and wildfire potential from prescribed fire and resource benefit fire in southwestern forests, USA. *Fire Ecology*, 7:108-121.
- Larson, A.J., Belote, R.T., Cansler, C.A., Parks, S.A., Dietz, M.S. 2013. Latent Resilience in Ponderosa Pine Forest: Effects of Resumed Frequent Fire. *Ecological Applications*, 23:1243-249.
- Laughlin, D.C., Fulé, P.Z. 2008. Wildland fire effects on understory plant communities in two fire-prone forests. *Canadian Journal of Forest Research*, 38:133-142.
- Parks, S.A., Miller, C., Nelson, C.R., Holder, Z.A. 2014. Previous fires moderate burn severity of subsequent wildland fires in two large western US wilderness areas. *Ecosystems*. DOI: 10.1007/s10021-013-9704-x.
- Taylor, A.H. 2010. Fire disturbance and forest structure in an old-growth *Pinus ponderosa* forest, southern Cascades, USA. *Journal of Vegetation Science*, 21:561-572.
- van Wageningen, J.W., van Wageningen, K.A., and Thode, A.E. 2012. Factors associated with the severity of intersecting fires in Yosemite National Park, California, USA. *Fire Ecology*, 8:11-32.

Senator Barasso Question 1

- Betancourt, J.L. 2015. Energy flow and the “grassification” of desert shrublands. *PNAS*, 112 (31) 9504-9505. doi:10.1073/pnas.1512078112
- Brooks, M.L., Matchett, J.R., Shinneman, D.J., and Coates, P.S., 2015. Fire patterns in the range of greater sage-grouse, 1984–2013—Implications for conservation and management: U.S. Geological Survey Open-File Report 2015-1167, 66 p., <http://dx.doi.org/10.3133/ofr20151167>.
- Brooks, M.L., D'antonio, C.M., Richardson, D.M., Grace, J.B., Keeley, J.E., DiTomaso, J.M., and Pyke, D. 2004. Effects of invasive alien plants on fire regimes. *BioScience*, 54(7), 677-688.
- Brusca, R.C., Wiens, J.F., Meyer, W.M., Edle, J., Franklin, K., Overpeck, J.T., Moore, W. 2013. Dramatic Response to Climate Change in the Southwest: Robert Whittaker's 1963 Arizona Mountain Plant Transect Revisited. *Ecology and Evolution*, 3, 3307-3319.
- Coates, P.S., Ricca, M.A., Prochazka, B.G., Doherty, K.E., Brooks, M.L., and Casazza, M.L. 2015. Long-term effects of wildfire on greater sage-grouse—Integrating population and ecosystem concepts for management in the Great Basin: U.S. Geological Survey Open-File Report 2015-1165, 42 p., <http://dx.doi.org/10.3133/ofr20151165>.
- Davies, K.W., and Nafus, A.M. 2013. Exotic annual grass invasion alters fuel amounts, continuity and moisture content. *International Journal of Wildland Fire*, 22(3), 353-358.
- Knick S.T., Dobkin D.S., Rotenberry J.T., Schroeder M.A., Vander Haegen W.M., Van Riper, C. III. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. *The Condor* 105: 611–634.
- Olsson, A.D., Betancourt, J., McClaran, M.P., and Marsh, S.E. 2012. Sonoran Desert Ecosystem transformation by a C4 grass without the grass/fire cycle. *Diversity and Distributions*, 18(1), 10-21.
- Pierson, F.B., Williams, C.J., Hardgreve, S.P., Weltz, M.A., Stone, J.J., and Clark, P.E. 2011. Fire, plant invasions, and erosion events on western rangelands. *Rangeland Ecology and Management*, 64(5), 439-449.
- Suding, K.N., Gross, K.L., and Houseman, G.R. 2004. Alternative states and positive feedbacks in restoration ecology. *Trends in Ecology and Evolution*, v. 19, p. 46–53.

U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington

- Williams, J.W., and Jackson, S.T. 2007. Novel climates, no-analog communities, and ecological surprises. *Frontiers in Ecology and the Environment*, 5(9), 475-482.
- Zouhar, K., Smith, J.K., Sutherland, S., and Brooks, M.L. 2008. Wildland fire in ecosystems: fire and nonnative invasive plants. General technical report. RMRS-GTR-42-vol. 6. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT.

Senator Barasso Question 2

- USDA Forest Service. Final Record of Decision: Four Forest Restoration Initiative. 2015.
https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3836454.pdf

Senator Warren Question 1

- Allen, C.D., and Breshears, D.D. (1998). Drought induced shift of a forest-woodland ecotone: rapid landscape response to climate variation. *Proceedings of the National Academy of Sciences*, 95: 14389-14842.
- Allen, C. D., Macalady, A. K., Chenchouni, H., Bachelet, D., McDowell, N., Vennetier, M., Kitzberger, T., Rigling, A., Breshears, D., Hogg, E.H., Gonzalez, P., Fensham, R., Zhang, Z., Castro, J., Demidova, N., Lim, J., Allard, G., Running, S.W., Semerci, A., and Cobb, N. 2010. A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests. *Forest Ecology and Management*, 259(4): 660-684.
- Bagdon, B., and Huang, C.H. 2014. Carbon Stocks and Climate Change: Management Implications in Northern Arizona Ponderosa Pine Forests. *Forests*, 5(4), 620-642.
- Covington, W.W., Everett, R.L., Steele, R., Irwin, L.L., Daer, T.A., and Allen, N.D. 1994. Historical and Anticipated Changes in Forest Ecosystems of the Inland West of the United States. *Journal of Sustainable Forestry*, 2:13-63.
- Garfin, G., Franco, G., Blanco, H., Comrie, A., Gonzalez, P., Piechota, T., Smyth, R., and Waskom, R. 2014. Ch. 20: Southwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J.M. Melillo, Terese (T.C.) Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 462-486. doi:10.7930/J08G8HMN.
- Grissino-Mayer, H.D., and Swetnam, T.W. 2000. Century-scale climate forcing of fire regimes in the American Southwest. *Holocene*, 10, 213-229.
- Kunkel, K.E., Stevens, L.E., Stevens, S.E., Sun, L., Janssen, E., Wuebbles, D., Redmond, K.T., and Dobson, J.G. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 5. Climate of the Southwest U.S. NOAA Technical Report NESDIS 142-5. 87 pp., National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.
- Laughlin, D.C., Fulé, P.Z., Huffman, D.W., Crouse, J., and Laliberte, E. 2011. Climatic constraints on trait-based forest assembly. *Journal of Ecology*, 99, 1489-1499.
- Lutz, J.A., van Wagtenonk, J.W., Thode, A.E., Miller, J.D., and Franklin, J.F. 2009. Climate, lightning ignitions, and fire severity in Yosemite National Park, California, USA. *International Journal of Wildland Fire*, 18: 765-774. doi:10.1071/WF08117
- Lutz, J.A., van Wagtenonk, J.W., and Franklin, J.F. 2010. Climatic water deficit, tree species ranges, and climate change in Yosemite National Park, USA. *Journal of Biogeography*, 37: 936-950. doi:10.1111/j.1365-2699.2009.02268.x
- Lutz, J.A., Key, C.H., Kolden, C.A., Kane, J.T., and van Wagtenonk, J.W. 2011. Fire frequency, area burned, and severity: what is a normal fire year? *Fire Ecology*, 7(2): 51-65. doi: 10.4996/fireecology.0702051
- McKenzie, D., Gedalof, Z.M., Peterson, D.L., and Mote, P. 2004. Climatic change, wildfire, and conservation. *Conservation Biology*, 18: 890-902. doi: 10.1111/j.1523-1739.2004.00492.x

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Dr. William Wallace Covington**

- Miller, J.D., and Thode, A.E. 2007. Quantifying burn severity in a heterogeneous landscape with a relative version of the delta Normalized Burn Ratio (dNBR). *Remote Sensing of Environment*, 109: 66-80. doi:10.1016/j.rse.2006.12.006
- Miller, J.D., Safford, H.D., Crimmins, M., and Thode, A.E. 2009. Quantitative evidence for increasing forest fire severity in the Sierra Nevada and Southern Cascade Mountains, California and Nevada, USA. *Ecosystems*, 12: 16-32. doi:10.1007/s10021-008-9201-9
- Rehfeldt, G.E., Crookston, N.L., Warwell, M.V., and J.S. Evans. 2006. Empirical analyses of plant-climate relationships for the Western United-States. *International Journal of Plant Science*, 167, 1123-1150.
- Stoddard, M.T., Meador, A.S., Fulé, P.Z., and J.E. Korb. 2015. Five-year post-restoration conditions and simulated climate-change trajectories in a warm/dry mixed-conifer forest, southwestern Colorado, USA. *Forest Ecology and Management*.
- Westerling, A.L., Hidalgo, H.G., Cayan, D.R., and T.W. Swetnam. 2006. Warming and earlier spring increase western US forest wildfire activity. *Science*, 313, 940-943.
- Williams, A.P., Allen, C.D., Macalady, A.K., Griffin, D., Woodhouse, C.A., Meko, D.M., Swetnam, T.W., Rauscher, S.A., Seager, R., Grissino-Mayer, H.D., Dean, J.S., Cook, E.R., Gangodagamage, C., Cai, M., and N.G. McDowell. 2012. Temperature as a potent driver of regional forest drought stress and tree mortality. *Nature Climate Change*, 3, 292-298.
- Williams, A.P., Seager, R., Macalady, A.K., Berkelhammer, M., Crimmins, M.A., Swetnam, T.W., Trugman, A.T., Buenning, N., Noone, D., McDowell, N.G., Hryniw, N., Mora, C.I., and T. Rahn. 2014a. Correlations between components of the water balance and burned area reveal new insights for predicting fire activity in the southwest United States. *International Journal of Wildland Fire*, 24:14-26.
- Williams, A.P., Seager, R., Berkelhammer, M., Macalady, A.K., Crimmins, M.A., Swetnam, T.W., Trugman, A.T., Buenning, N., Hryniw, N., McDowell, N.G., Noone, D., Mora, C.I., and T. Rahn. 2014b. Causes and Implications of Extreme Atmospheric Moisture Demand during the Record-Breaking 2011 Wildfire Season in the Southwestern United States. *Journal of Applied Meteorology and Climatology*, 53: 2671-2684.
- Senator Warren Question 2**
- Azpeleta Tarancón, A., Fulé, P.Z., Shive, K.L., Sieg, C.H., Sánchez Meador, A., Strom, B., 2014. Simulating post-wildfire forest trajectories under alternative climate and management scenarios. *Ecological Applications* doi: <http://dx.doi.org/10.1890/13-1787.1>
- Brusca, R.C., Wiens, J.F., Meyer, W.M., Edle, J. Franklin, K., Overpeck, J.T., Moore, W., 2013. Dramatic Response to Climate Change in the Southwest: Robert Whittaker's 1963 Arizona Mountain Plant Transect Revisited. *Ecology and Evolution*, 3, 3307-3319.
- Pechony, O., and Shindell, D.T., 2010. Driving forces of global wildfires over the past millennium and the forthcoming century. *Proc. Natl. Acad. Sci.*, 107, 19167- 19170
- Smith, H.G., Sheridan, G.J., Lane, N.J., Nyman, P., Haydon, S. 2011. Wildfire effects on water quality in forest catchments: A review with implications for water supply. *Journal of Hydrology*, 396 170-192.
- Westerling, A.L., Hidalgo, H.G., Cayan, D.R., and Swetnam, T.W. 2006. Warming and earlier spring increases western U.S. forest wildfire activity. *Science*, 313:940-943. doi:10.1126/science.1128834
- Williams, A.P., Allen, C.D., Macalady, A.K., Griffin, D., Woodhouse, C.A., Meko, D.M., Swetnam, T.W., Rauscher, S.A., Seager, R., Grissino-Mayer, H.D., Dean, J.S., Cook, E.R., Gangodagamage, C., Cai, M., and McDowell, N.G. 2012. Temperature as a potent driver of regional forest drought stress and tree mortality. *Nature Climate Change*, 3:292-297.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Chief Mike Burnett**

Questions from Chairman Lisa Murkowski

Question 1: In your opinion, what steps does the Federal government need to take to accomplish more hazardous fuels reduction work?

In my opinion, there are several steps the Federal government needs to take to improve their efforts towards hazardous fuels reduction work;

- Adequately fund forest health collaboratives.
- Increase the appropriations for mechanical thinning and prescribed burning.
- Appropriately fund, and staff, vegetation and fuel management programs.
- Work with local forests to re-establish small log sawmill infrastructure.

Question 2: What roadblocks, in your observation, are preventing the land management agencies from carrying out these much needed hazardous fuels reduction projects?

I believe the land management agencies would be able to do more hazardous fuel reduction projects if;

- There was a revision to smoke management policies.
- There was better collaboration between State and Federal agencies with the inclusion of private landowners.
- There was existing infrastructure to handle the thinning projects.
- The Federal government would create a financial incentive, through funding, for forest to do hazardous fuel reduction.

Question 3: In your experience, do post-fire reviews conducted by the Forest Service or DOI agencies include the pre-fire forest condition or factors that may have predisposed the land to a large, costly fire, such as over accumulation of vegetation, or do the reviews just assess suppression actions and decisions? If the entire focus is on fire managers and suppression actions, do you think it puts too much focus on suppression activities and not enough on actions that could have been taken prior to the fire to address the pre-fire forest conditions?

My experiences with post-fire reviews have been in the form of after action reviews and incident management team performance evaluations. In this setting, the focus is clearly on suppression actions and decisions.

There are frequent discussions with Agency Administrators during the incident regarding planned strategies that take into consideration firefighter safety and opportunities for success based on multiple variables. An example would be the evaluation of areas with excessive fuel loading versus areas that have had fuel treatment.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

Senator Barrasso,

Thank you for the opportunity to provide additional detail to the testimony and for your questions. Please accept these answers for the record.

Questions from Senator John Barrasso

Question 1: Very often those who oppose active management of our forests claim hazardous fuel removal projects, timber production or thinning activities will destroy watershed health and wildlife habitat. Your testimony illustrates the costs of not taking a balanced approach to treating the landscape. In your testimony you cite the negative long term impacts on salmon, wildlife, watersheds, infrastructure, and farmers, ranchers, and tribes that will extend many years into the future.

What are some of these natural resource problems you are facing or will face in the future now that the fires are out?

Answer:

Given the size, scale, and intensity, of the fires, there is little or no natural regeneration of softwood forest species on large swaths of land. Brush will quickly dominate the native grasses in these burned areas, making them unsuitable for wildlife habitat, grazing, providing little shade for burned riparian areas, and ultimately creating yet another fuel source for future fires.

Being left with a burned-out, sterile, landscape, leaves private landowners, government owned lands and our tribal lands with a number of unattractive choices. Do nothing, and you get the brush- and weed-laden land that is highly erodible, highly unproductive, and may or may not some day return to forest depending literally on the winds and the travels of birds and squirrels.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

This choice essentially ensures large areas of dead land for generations. If the choice is to replant, one will incur land preparation, salvage harvesting, brush removal, weed control, road construction and maintenance costs, as well as the cost of seedlings and planting, that will run into the hundreds, if not thousands, of dollars per acre.

The return on this investment has such a long horizon that it really becomes a commitment based on faith that it is the right thing to do, because your descendants who have not been born will be the ones who either benefit or not from decisions you make today.

The costs of any of these management approaches are real. Even if you are on the end of the spectrum that believes land and timber devastated by fire should be left alone to let nature take her course, our counties and reservations will require that you spray for noxious weeds (or have a lien attached to your property for lands outside the boundaries of the reservation). If your burned trees fall over a road, or if the salmon stream that runs through your place and is now filling in with silt from your formerly heavily timbered riparian zone, you are likely to face some or all of the costs of remediation of these problems.

The loss of wildlife habitat is significant. We already have 10,000+ deer without winter feed, including the bitter brush that is a natural component of their diet. Bitterbrush must be hand replanted to be effective and no funds are available to do this work and it will take generations to re-grow.

The true cost of fire devastation needs to be assessed in terms not only of salvage, replanting, brush and weed control, but of losing the productivity of the land over a very long term horizon, including the loss of jobs, recreation, and access to the lands. I have included as "Exhibit A" a photo of the devastation from these fire super storms and then below the devastation a picture of the noxious weeds that have returned causing additional ecological and natural resource challenges.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

“Exhibit B” shows mudslides that occurred on Forest Service lands within Okanogan County just outside of Pateros, Washington. The area is known as Black Canyon which burned in the 2014 Carlton Complex Fires and the 2015 Chelan Complex Fires. The area burned in 2014 was not salvaged logged and was left to become the fuel for the 2015 fires in the same area.

The back to back burning of this area by forest fires has made the ground sterile and subject to mudslides. The mudslide depicted in these photos occurred within a few days of the senate hearing. This damage will continue for years to come if not properly addressed by the Forest Service.

Gene Shull, a fisheries biologist, discussed the Black Canyon mudslide in the Methow Valley News November 20, 2015 and said: “The damage is extensive. Multiple failures occurred on Black Canyon Road about halfway up the drainage. Repairs to the road will be time-consuming and expensive and impacts to critical steelhead habitat from sediment deposits into Black Canyon Creek from the washout are severe. Thousands of cubic yards of fine sediment was delivered to Black Canyon Creek. Steelhead spawning and rearing habitat will be impacted for a few more years.”

The mudslides will have a negative impact on our tourism economy, limit access to national forests, and increases the costs from the fires. The costs may be so high, that the access area and roads are just left to nature which removes access to the lands all together. We know at this time that the road will remain closed to all wheeled and tracked vehicles through the winter and the groomed snowmobile route in the area will also be closed for the winter.

Additionally, in “Exhibit C” is a second example of mudslides from another burned area in Chelan County just outside of Entiat, Washington taken from the USFS Facebook webpage for the region.

Last in regards to the tribal lands we have challenges facing some of the best subsistence gathering grounds. The western portion of the Colville Reservation that was in the Tunk Block and North Star fire are some of the

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

best grounds for gathering huckleberries, chokecherries, soapberries, and strawberries. These lands were destroyed and recently the tribal council voted to close tribal lands in the burn areas to subsistence hunting.

The tribal lands will also need to replant as many of the burned and logged areas as possible. Cody Desautel, the tribe's natural resources director, said in the Seattle Times November 21, 2015 "The tribes will replant as much of the burned and logged land as they can. But on this scale of destruction, that too will be a struggle, with an estimated 30 million trees needed to replant so large an area. We do two or three million in our best year. We'll be extremely lucky to get half of that done."

Assuming we are unable to get financial incentives put in place for the balanced active management approach that I espouse in the near future, we need a clear-eyed analysis of the true costs of allowing fires to become these super storms should be part of the national discussion. Everyone now understands that the USFS has to borrow from its other programs, and tap emergency programs, because the cost of firefighting has eaten up the budget in the first few weeks of the fire season, for several seasons running. The practice of fire borrowing should stop.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

Question 2: In your testimony you state the U.S. Forest Service has four times more land that owned by the State of Washington. Yet, the Washington State Department of Natural Resources has harvested 30 times more volume and has been 1283 time more profitable than the Forest Service.

In your view, which forests are healthier, have greater wildlife habitat diversity, or pose less of a wildfire risk, the state or national forests?

Answer:

At the current time I personally believe the State Department of Natural Resources (DNR) is better able to manage their properties because of local control and the financial incentives to optimize the productivity. This was not always the case. In my submitted testimony I had attached Exhibit B, which has been attached again here are "Exhibit D." The map clearly shows that during the mid 80's the Forest Service managed the lands better, but a shift occurred in 1991 to where the state began to manage the lands better, a trend that continues through today.

We have seen opposition to DNR Forest practices by the environmental community but not every project is opposed. Many realize the part that DNR land plays in the funding of education and other programs is not lost on the population. The Forest Service, on the other hand, is burdened by it's size and a constituency that includes the largest and best-funded groups who wish to stop all logging. Without local input and some degree of local control, it is hard to see how the conflict is resolved.

"Exhibit E" gives a real world example by Bob Schumacher of managed Forest Service Lands and non managed Forest Service Lands from this year's fires in Okanogan County. Bob Schumacher a consulting forester who works in both the southeastern and northwestern United States. He owns property in Okanogan County.

The example in "Exhibit E" should resonate through all government agencies depicting successful management of Forest Service Lands, yet

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

shows the devastation when the Forest Service is unable to complete the necessary treatments.

If we were to end fire borrowing, it could lead to reversing this trend of Forest Service lands being unmanaged and having the national forest lands managed at a comparable level to the state or even better than the state as they were in the 80's.

I have included for you in "Exhibit F" pictures taken of lands within the Okanogan-Wenatchee National Forest detailing the unmanaged lands and what they looked like when ablaze during the 2015 fires.

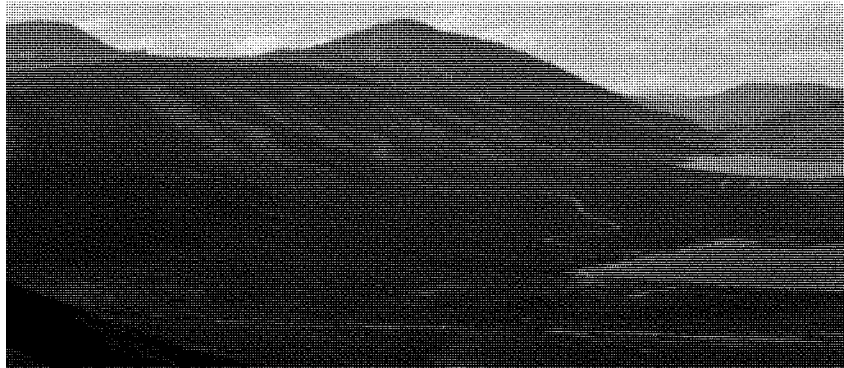
I then added a picture of lands managed by the local Department of Natural Resources within Washington State showing a tract that was logged, thinned, prescriptively burned, and grazed by cattle. This tract of land abuts the Okanogan-Wenatchee National Forest and clearly shows habitat that poses less wildfire risk and greater wildlife habitat diversity which was your question.

The last photo in the exhibit is that of the National Forest lands burned in 2006 as part of the Tri-Pod fire that burned over 240,00 acres. The photo clearly shows the logs have been left to become fuel for the next fire and little to no habitat on the ground has grown back since 2006, therefore increasing wildfire risk and less wildlife habitat diversity.

I would conclude by saying biofuel technology has been around since the 60s, and although it is tantalizingly promising it has not become commercially viable over the past decades. It seems that a cold hard analysis of the true total costs imposed by the governments and private sector of these devastating fires would show that government subsidies and/or incentives to get contractors out into the woods thinning, cutting brush, maintaining roads and culverts, planting trees in riparian zones, etc., will likely be far less, over time, than the devastating wildfire, and provide a much better result, financially and culturally, than simply doing nothing and scrambling every year with these disastrous fire crises.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

EXHIBIT A



Fires Devastation to the Land



NOXIOUS WEEDS AFTER THE FIRES – REGROWTH AFTER CARLTON
COMPLEX FIRES OF 2014

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

EXHIBIT B

U.S. Forest Service - Okanogan-Wenatchee National Forest added 3 new photos.
November 18 at 5:53pm

A culvert on Black Canyon Road (Forest Road 4010 on the Methow Valley Ranger District) was plugged by debris during recent storms leading to road damage and a temporary closure.



**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

EXHIBIT C

U.S. Forest Service - Okanogan-Wenatchee National Forest added 7 new photos.
November 19 at 10:46am

Recent rains and the freeze-thaw cycle have created hazardous conditions on some national forest roads and trails on the Entiat, Wenatchee River, Cle Elum, and Methow Valley ranger districts. Rocks, mud, trees and other debris have impacted different areas of the national forest.

Recreationists visiting campgrounds or trails located near streams, or riving forest roads, need to be cautious and alert for high and fast running water, woody debris or log jams, and fallen trees.

Water across roadways could indicate a blocked culvert and increased potential for a road washout. Visitors are discouraged from walking or driving across sections or roadway that may have standing or flowing water or debris flows. Do not attempt to go around barricades.

In areas where there have been recent large fires, people should be extra cautious because this may be the first major runoff the fire area has experienced and slopes could still be unstable.

Forest Service employees will be checking forest roads and recreation areas for damage, unplugging culverts and removing trees from roadways.

Before leaving home, the public is urged to check weather forecasts and contact local ranger stations to learn current road and trail conditions for the area where they will be recreating. Also, carry a map of the area and think about alternate exit routes in case the main route becomes inaccessible or blocked.

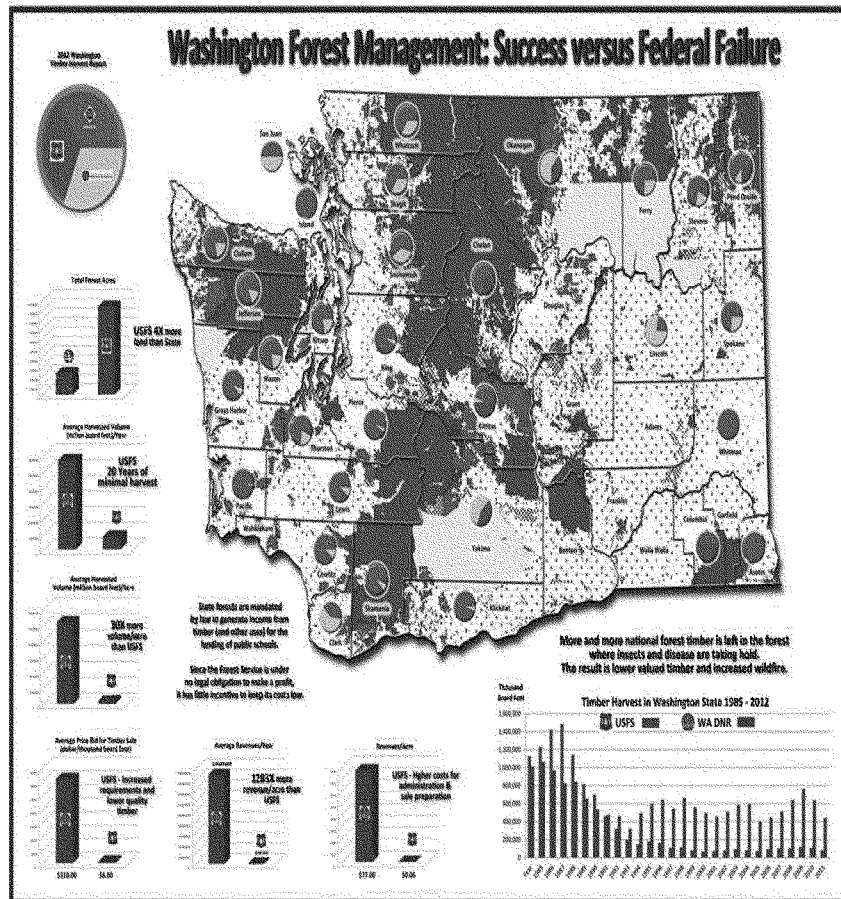
These photos are of two separate mud and debris slides 25 miles up Entiat River Road just past the sno-park. Also see the earlier post about the Black Canyon Road washout.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**



U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss

EXHIBIT D



**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

EXHIBIT E

Spokesman Review November 15, 2015

Guest opinion: Okanogan fires shows pre-emptive forest management works

Bob Schumacher

Tags: Aeneas Valley fire management North Star fire Tunk Block fire u.s. forest service

This past August and September, I gained more experience with wildfire than I ever cared to. I arrived at my off-the-grid cabin in the Aeneas Valley of Okanogan County just as the North Star fire broke out. A few days later, the Tunk Block fire threatened from a different direction. I watched with apprehension as enormous columns of smoke billowed into the blue Washington skies, punching so high into the atmosphere that clouds formed above the convection columns. Each night I could see flames in the distance. Balls of fire flashed into view and faded, each representing trees being consumed in a crown fire.

My property, some 800 feet in elevation above the valley floor, offered an excellent vantage point. And as a professional forester, I could interpret what I saw, even though I had limited fire experience. I knew that some of the U.S. Forest Service land south of Aeneas Valley had recently been treated to reduce fuel loads. This is a two-step process. First, dense forests are thinned, removing enough trees and underbrush to disrupt the “ladder fuels” that encourage crown fires. Next, a controlled burn is conducted during cool weather. When the inevitable wildfire arrives, little fuel remains to be burned. That’s the theory anyway; the test had come in the form of the North Star and Tunk Block fires.

As the fires raged and the prospect of control was very much in doubt, I attended public meetings, studied fire maps, spoke with key personnel, and made my own observations. I specifically asked four fire bosses whether the fuel-treatment zones were helping. All of them enthusiastically said yes. In fact, the official fire report from Sept. 5 says in part:

“Benefit of fuel treatments: The forest thinning and fuels treatments in the south and east forested edges of Aeneas Valley modified fire behavior, slowing its spread as well as facilitating burnouts and allowing firefighters to establish effective containment lines that protected homes and land.”

Once the fires were contained and the woods reopened to the public, I made two trips into the burned areas. First, I visited the northwest reaches of the North Star fire, in the vicinity of Lyman Lake Road and Devils Canyon. Many of the managed forest stands displayed little damage at all, appearing much the same as I had seen them a year ago. A few treated areas had been lost, but considering the extreme conditions that prevailed — hot windy days and low fuel moisture — the survival of so much timber was impressive.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

My second foray into the woods took me to the northeastern part of the Tunk Block fire, near Peony Creek at the west end of Aeneas Valley. Here, the difference between treated and untreated forests was even clearer. Along Forest Service Road 3010, thinned forests stood green and healthy. Judging from the scarcely-burned ground vegetation, it was hard to imagine that a destructive wildfire had loomed nearby. When I turned the corner onto Road 3015, the destruction wrought by the Tunk Block fire came into view. On the south side of the road, where trees of all sizes and ages had been crowded together, little remained besides charred trunks. Virtually every needle on every tree had been vaporized. Ash coated the ground, and not a speck of green was to be seen. Trees that had taken root while Thomas Jefferson was president had been incinerated within seconds.

To the north of the road, where ladder fuels had been removed, survival was nearly 100 percent. Not only were the trees alive, they had barely even been scorched. The fire had burned so meekly that green seedlings still poked from the ground.

And so it is, that within the boundaries of one of the largest wildfires in the state's recent history, in a month with some of the most extreme fire weather imaginable, large swaths of green forest remain; and the sprawling wildland-urban interface of Aeneas Valley was saved. This did not happen as a result of a bold stroke of genius or a previously unknown technology. Instead, it was the result of tried-and-true forest management practices that have been known for decades.

Some environmental activists adamantly claim that fuel reduction projects do not work, and are merely a ploy to harvest more timber. I invite any doubters to go to the places that I went, and see what I have seen. Preemptive fire management saves forests and property. It can and should be widely employed in the Inland Northwest.

Bob Schumacher a consulting forester who works in both the southeastern and northwestern United States. He owns property in Okanogan County.

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**

EXHIBIT F



Okanogan Wenatchee National Forest unmanaged and waiting for a high intensity burn.
Picture taken 8/24/2015



Okanogan Wenatchee National Forest unmanaged and high intensity burn.
Picture taken 8/24/2015

**U.S. Senate Committee on Energy and Natural Resources
November 17, 2015 Hearing: Future Federal Wildland Fire Management Strategies
Questions for the Record Submitted to Mr. Jon Wyss**



Washington State Department of Natural Resource Land that was logged, thinned, prescriptively burned, and grazed by cattle.
Picture taken 10/01/2015



Tripod Fire 2006 burned approximately 240,000 acres.
Picture taken 10/01/2015



United States Government Accountability Office

Report to Congressional Requesters

August 2013

WILDLAND FIRE MANAGEMENT

Improvements Needed
in Information,
Collaboration, and
Planning to Enhance
Federal Fire Aviation
Program Success

GAO-13-684

GAO Highlights

Highlights of GAO-13-666, a report to congressional committees

Why GAO Did This Study

The Forest Service and Interior contract for aircraft to perform various firefighting functions, including airtankers for deep penetration. The Forest Service contracts for large airtankers and certain other aircraft, while Interior contracts for smaller airtankers and water scoopers. However, a decrease in the number of large airtankers, from 44 in 2002 to 5 in early 2013—due to aging planes and several fatal crashes—has led to concerns about the agencies' ability to provide aerial firefighting support.

GAO was asked to review agency efforts to ensure the adequacy of the firefighting aircraft fleet. This report examines (1) Forest Service and Interior efforts to identify the number and type of firefighting aircraft they need and (2) the Forest Service's approach to modernizing the large airtanker fleet and the challenges it faces in doing so. GAO reviewed agency advice and strategies, assessed the extent to which they included key elements important for understanding the aviation needs, reviewed large airtanker planning and acquisition documents, and interviewed agency officials and representatives of the fire aviation community selected to represent state agencies, aircraft vendors, and others.

What GAO Recommends

GAO recommends, among other things, that the Forest Service and Interior expand efforts to collect information on the performance and effectiveness of firefighting aircraft and enhance collaboration across agencies and the fire aviation community. The agencies generally agreed with GAO's findings and recommendations.

New GAO-13-666. For more information, contact Kate Mark Fennel at (202) 512-5821 or kfennel@gao.gov.

August 2013

WILDLAND FIRE MANAGEMENT**Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success****What GAO Found**

The Department of Agriculture's Forest Service and the Department of the Interior have undertaken nine major efforts since 1995 to identify the number and type of firefighting aircraft they need, but those efforts—consisting of major studies and strategy documents—have been hampered by limited information and collaboration. Specifically, the studies and strategy documents did not incorporate information on the performance and effectiveness of firefighting aircraft, primarily because neither agency collected such data. While government reports have long called for the Forest Service and Interior to collect aircraft performance information, neither agency did so until 2012 when the Forest Service began a data collection effort. However, the Forest Service has collected limited data on large airtankers and no other aircraft, and Interior has not initiated a data collection effort. In addition, although firefighting aircraft are often shared by federal agencies and can be deployed to support firefighting operations on federal and nonfederal lands, the agencies have not consistently collaborated with one another and other stakeholders to identify the firefighting aircraft they need. Many agency officials and stakeholders GAO contacted noted concerns about limited collaboration, and many cited shortcomings with the formal mechanism for collaboration—the National Interagency Aviation Committee. The committee has implemented some leading practices for collaboration such as defining and articulating a common purpose, but it has not taken additional steps to monitor and evaluate its collaborative activities, another leading practice. Collectively, additional information on aircraft performance and effectiveness and collaboration across agencies and with stakeholders could enhance agency estimates of their firefighting aircraft needs to more accurately represent national needs for such aircraft, and as a result, better position the agencies to develop strategic planning documents that represent those needs.

The Forest Service plans to modernize the large airtanker fleet by obtaining large airtankers from various sources over the near, medium, and long term, but each component of this approach faces challenges that make the continued availability of such aircraft to meet national fire suppression needs uncertain. In the near term, the agency plans to rely on a mix of contracted "legacy" airtankers as well as supplemental aircraft available through additional contracts and agreements with other governments and the military. However, agency concerns exist regarding the availability, capability, and costs of these resources. In the medium term, the Forest Service has awarded contracts for "next-generation" large airtankers that are faster and more up-to-date than most "legacy" aircraft, but it is uncertain when all of these aircraft will begin supporting fire suppression activities. Specifically, bid protests delayed contract issuance, and most of the aircraft receiving awards have not been fully tested and approved. In the long term, the Forest Service's plan includes purchasing certain large airtankers and obtaining others through intergovernmental transfer at no initial cost if they are declared surplus by the military—a shift from its long-standing practice of contracting for rather than owning aircraft. However, the Forest Service was unable to justify its previous plans for purchasing large airtankers to the Office of Management and Budget, and concerns exist regarding the retardant capacity and operating cost of the other airtankers it would obtain through intergovernmental transfer.

United States Government Accountability Office

Contents

Letter		1
	Background	5
	Agencies' Efforts to Identify Firefighting Aircraft Needs Have Been Hampered by Limited Information and Collaboration	11
	The Forest Service's Approach to Modernizing the Large Airtanker Fleet Faces Challenges, Resulting in Uncertainty over Continued Large Airtanker Availability	21
	Conclusions	36
	Recommendations for Executive Action	37
	Agency Comments and Our Evaluation	37
Appendix I	Objectives, Scope, and Methodology	39
Appendix II	2013 Forest Service and Interior Firefighting Aircraft Availability and Rates	42
Appendix III	Summary of Agency Efforts Since 1995 to Identify Number and Type of Firefighting Aircraft They Need	44
Appendix IV	Comments from the Department of Agriculture	47
Appendix V	Comments from the Department of the Interior	49
Appendix VI	GAO Contact and Staff Acknowledgments	50
Tables		
	Table 1: Firefighting Aircraft Categories and Functions	6
	Table 2: Type, Number, and Cost Rates for Federally-Contracted Firefighting Aircraft	42

Table 3: Purpose, Methodology, and Recommendations of Major Efforts to Identify Federal Firefighting Aircraft Needs, by Date	44
--	----

Figures

Figure 1: Examples of Single-Engine and Large Airtankers Used in Wildland Fire Suppression	3
Figure 2: Key Elements Included in Major Forest Service and Interior Efforts Since 1995 to Identify Number and Type of Firefighting Aircraft They Need	12
Figure 3: Example of a DC-10 Very Large Airtanker Dropping Retardant	25
Figure 4: Example of MAFFS-equipped C-130	28
Figure 5: Example of a "Next-Generation" Large Airtanker (BAe-146)	30

Abbreviations

CAL FIRE	California Department of Forestry and Fire Protection
DOD	Department of Defense
MAFFS	Modular Airborne Firefighting System
OMB	Office of Management and Budget

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



U.S. GOVERNMENT ACCOUNTABILITY OFFICE

441 G St. N.W.
Washington, DC 20548

August 20, 2013

The Honorable Ron Wyden
Chairman
The Honorable Lisa Murkowski
Ranking Member
Committee on Energy and Natural Resources
United States Senate

The Honorable Dianne Feinstein
United States Senate

The Honorable Jon Tester
United States Senate

The Honorable Mark Udall
United States Senate

Over the last 5 decades, aircraft have played an important role in wildland fire suppression activities throughout the country by conducting aerial surveillance, delivering supplies and firefighters, and dropping retardant to slow fire growth or water to suppress fires. Federal, state, and local governments rely on firefighting aircraft—including fixed-wing airtankers, helicopters, and other aircraft—to help protect communities and natural resources from wildland fire, and experts project that, as fire seasons become longer and more severe, the need for firefighting aircraft will continue to grow. The federal government plays a central role in wildland fire response, including the use of firefighting aircraft, for which it largely relies on private vendors that own and operate the aircraft under contract to the government.

Among firefighting aircraft, large airtankers—those able to carry at least 1,800 gallons of fire retardant—are key resources for the federal government because they have the ability to fly to remote areas and quickly assist in containing small fires before they become larger, costlier, and more dangerous. However, the number of large airtankers available under federal contract decreased substantially in the last decade, from 44 in 2002 to 8 in early 2013.¹ The decrease of large airtankers in the federal

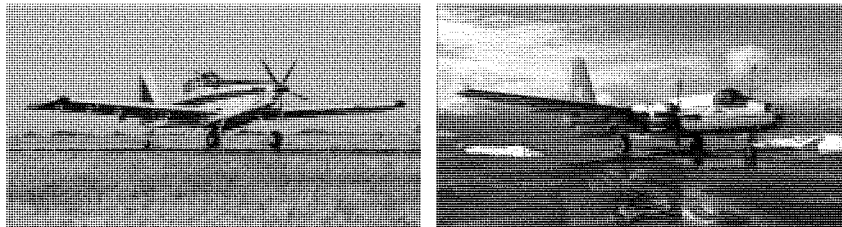
¹Unless otherwise specified, all years cited in this report refer to calendar years.

fleet is, in part, the result of aircraft being retired due to their age—the average large airtanker is more than 50 years old—as well as agencies' concerns about the airtankers' safety and capability to perform a demanding fire aviation mission, which involves maneuvering aircraft at low speeds and altitude and enduring significant structural wing stress. Safety issues arose from two fatal crashes in 2002, both of which were caused by structural failures—specifically, wings separating from the aircraft during flight. These safety-related concerns led the government in 2011 to terminate contracts for eight large airtankers, which represented more than 40 percent of the federally-contracted large airtanker fleet at the time. Three additional crashes in 2012, two of which resulted in fatalities, further increased public concerns regarding the federal government's ability to provide continued aerial support for wildland firefighting activities.

Aircraft availability is also limited by the market characteristics for each type of aircraft. In particular, large airtankers are less available than other aircraft such as single-engine airtankers, helicopters, and surveillance aircraft.² Large airtankers have historically consisted of larger aircraft—typically surplus from the military—that were not designed to drop liquids and have undergone retrofitting to perform that mission. (See fig. 1 for examples of single-engine and large airtankers). According to the federal government's 2009 wildland fire aviation strategy, the availability of single-engine airtankers and helicopters is sufficient to meet national fire demands over the next 15 to 20 years, and the availability of aerial surveillance and smokejumper aircraft is adequate, but the Forest Service's recent large airtanker strategy notes that the economic difficulty for new vendors to enter the market or existing vendors to upgrade their fleets demonstrates the uncertainty regarding the continued availability of large airtankers.

²Single-engine airtankers are often agricultural aircraft designed to operate at low altitudes and configured to drop retardant rather than pesticides or fertilizer. Helicopters can perform multiple roles—including oil and gas, logging, and fire suppression support—and surveillance aircraft are typically general-purpose civilian aircraft.

Figure 1: Examples of Single-Engine and Large Airtankers Used in Wildland Fire Suppression



Sources: Air Tractor Inc. (left), GAO (right).

Air Tractor AT-802F single-engine airtanker.

Korean War-era Lockheed P-2V Neptune owned by Neptune Aviation Services, originally a maritime patrol aircraft now converted to a large airtanker.

Note: Large airtankers are defined by the agencies as aircraft with capacities of at least 1,800 gallons. Small, single-engine airtankers generally have capacities of 500 to 800 gallons.

The Department of Agriculture's Forest Service and the Department of the Interior's land management bureaus have a responsibility to respond to wildland fires on federal lands.³ States and other entities—including tribal and local fire departments—have primary responsibility for responding to wildland fires on tribal, state, local, and private lands. Fighting wildland fires—which can burn across federal, state, and local jurisdictions—can require significant investments of personnel, aircraft, equipment, and supplies and can result in substantial fire suppression expenditures, with firefighting aircraft contributing to these costs. From 2007 through 2012, these agencies reported that more than \$2.4 billion was spent on federally-contracted firefighting aircraft, fuel, and retardant.⁴

In light of questions about the availability of needed aerial support for firefighting—in particular the decrease in large airtanker availability—you

³The Department of the Interior includes four land management agencies: the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service.

⁴This amount includes expenditures for both federal and nonfederal use of these contracted aircraft.

asked us to review federal agencies' efforts to ensure the adequacy of the federal firefighting aircraft fleet. This report examines (1) Forest Service and Interior efforts to identify the number and type of firefighting aircraft they need, and (2) the Forest Service's approach to modernizing the large airtanker fleet and the challenges it faces in doing so.

To examine Forest Service and Interior efforts to identify their firefighting aircraft needs, we identified and reviewed agency studies and strategy documents and interviewed agency officials responsible for managing fire aviation programs. We focused on those efforts conducted since 1995, when the Forest Service and Interior jointly conducted the first major study of their large airtanker needs. For each effort, we reviewed the methodologies used and identified the extent to which they included analysis of key elements, which we identified as important for understanding firefighting aircraft needs based on our reviews of multiple academic and agency studies and interviews with numerous stakeholders throughout the fire aviation community. The key elements we identified are: aircraft types, basing options, acquisition models, aircraft capabilities, suppression methods, and aircraft performance and effectiveness. We also interviewed agency officials about each effort to determine the extent of federal interagency collaboration involved. We compared the agencies' practices with GAO-identified leading practices for interagency collaboration.⁵ To examine the Forest Service's approach to modernizing the large airtanker fleet and any challenges it faces in doing so, we reviewed agency documents related to large airtanker acquisition, management, and operations as well as planning and acquisition documents, such as the 2009 *Interagency Aviation Strategy*, the Forest Service's 2012 *Large Airtanker Modernization Strategy*, and Forest Service airtanker contract solicitations, which lay out the agency's approach to obtaining large airtankers. For both objectives, we interviewed members of the fire aviation stakeholder community, including officials involved in the management and operations of aerial firefighting from the Forest Service, Interior and its four land management bureaus, the Department of Defense (DOD), and six state agencies that we selected based on input from federal agencies and the National Association of State Foresters; representatives from eight of the nine vendors we identified that own and operate large airtankers and that have

⁵See GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, GAO-06-15 (Washington, D.C.: Oct. 21, 2005).

responded to the most recent Forest Service contract solicitations;⁶ and two national trade organizations, which we identified based on conversations with agency officials and vendor representatives. We also conducted site visits to the National Interagency Fire Center in Boise, Idaho;⁷ the facilities of the only two private vendors with active Forest Service "legacy" large airtanker contracts, located in Minden, Nevada and Missoula, Montana; and the headquarters of California's fire aviation program—part of the California Department of Forestry and Fire Protection (CAL FIRE) in Sacramento.⁸ The results of our interviews and site visits are not generalizable. Appendix I provides a more detailed description of our objectives, scope, and methodology.

We conducted this performance audit from August 2012 to August 2013 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

For decades, the federal government has relied on firefighting aircraft to assist in wildland fire suppression activities. These aircraft perform various firefighting activities, including gathering intelligence by detecting fires and conducting assessments of ongoing fires; delivering supplies such as water, food, and ground-based firefighting equipment; transporting firefighters; providing coordination and direction to aerial and ground-based firefighters; and delivering retardant or water to extinguish or slow the growth of fires. The federal government uses different types of firefighting aircraft, including large airtankers, very large airtankers, single-engine airtankers, amphibious fixed-wing water scoopers, helicopters, and fixed-wing surveillance and smokejumper aircraft to

⁶Representatives of the ninth vendor did not respond to our attempts to contact them.

⁷The National Interagency Fire Center is the nation's logistical support center for controlling and extinguishing wildland fires and coordinates the mobilization of fire suppression supplies, equipment, and personnel at the federal, regional, and local levels.

⁸CAL FIRE operates a fleet of airtankers, helicopters, and surveillance aircraft to assist in fire suppression activities. The federal government reimburses the state of California when these aircraft support fire suppression activities on federal lands.

perform these aerial fire suppression activities. Table 1 describes these firefighting aircraft and their functions. In general, multiple types of aircraft operate simultaneously to suppress fires. For example, airtankers that drop retardant or water often work in tandem with surveillance aircraft—lead planes—that coordinate the firefighting operation and guide the airtankers in dropping the retardant or water in the correct location. The 2013 *Interagency Standards for Fire and Fire Aviation Operations* defines several types of federal firefighting aircraft—including large and very large airtankers, large and medium helicopters, and surveillance and smokejumper aircraft—as national resources that can be deployed anywhere in the country and support fire suppression operations in any jurisdiction, including federal lands and nonfederal lands in accordance with relevant intergovernmental agreements.⁹

Table 1: Firefighting Aircraft Categories and Functions

Aircraft category	Aerial firefighting function(s)
Large and very large airtankers	Deliver a minimum of 1,800 gallons (for large airtankers) or 8,000 gallons (for very large airtankers) of retardant to help suppress wildland fires; their range allows for rapid deployment over long distances, enabling them to support fire suppression activities across geographic boundaries
Single-engine airtankers	Deliver smaller amounts of retardant—currently, up to 800 gallons—to help suppress wildland fires; due to their small size and aerodynamics, they are capable of great accuracy in rough terrain
Water scoopers	Deliver water collected from sources such as rivers or lakes for use in suppressing wildland fires; currently-contracted aircraft carry up to 1,400 gallons
Helicopters	Perform various firefighting functions, including transporting firefighters or supplies as well as delivering water or retardant
Surveillance aircraft	Provide command and control of aerial resources assigned to a fire as well as coordination and direction of ground forces engaged in fire suppression activities; one type—lead planes—guide airtankers over fires to assist in accurately targeting retardant delivery
Smokejumper aircraft	Deliver firefighters and supplies quickly to remote fires by parachute; the aircraft's mobility allows for rapid support on emerging fires

Source: GAO analysis of agency documents.

⁹Single-engine airtankers and small helicopters are not defined as national resources by the *Interagency Standards for Fire and Fire Aviation Operations*. Officials told us that such aircraft are limited in their range and speed, and as a result, they are generally deployed within a specific geographic area.

In most instances, firefighting aircraft that drop retardant or water do not extinguish wildland fires but instead slow the spread of fires or reduce their intensity as firefighters on the ground work to contain or suppress fires. Firefighting aircraft that deliver retardant or water support ground-based firefighters by performing two main functions: (1) dropping retardant around wildland fires to slow fire growth to provide ground-based firefighters additional time to build or reinforce fireline and (2) reducing the intensity of fires by dropping water directly on them.¹⁰ In general, airtankers deliver retardant around fires to slow their spread, water scoopers drop water directly on fires to reduce their intensity, and helicopters can perform either function. Currently, all large and very large airtankers in the federal fleet are aircraft initially designed for other purposes—such as maritime patrol or civilian passenger transport—that have been retrofitted for the aerial fire suppression mission through the incorporation of retardant delivery systems—tanks affixed to aircraft that hold and release retardant.¹¹ Conversely, single-engine airtankers and water scoopers are built to drop retardant and water, respectively, to fight wildland fires.¹² Traditionally, airtankers have used retardant delivery systems that rely on gravity to evacuate retardant via doors that open in the bottom of the aircraft. However, some systems have been developed that use compressed air to force retardant out of the aircraft through nozzles rather than doors.

Fire suppression activities can generally be categorized as initial attack, extended attack, or large fire support. Initial attack activities include those conducted during the first “operational period” after the fire is reported, generally within 24 hours.¹³ When fires are not controlled through initial attack, extended attack activities occur that generally involve the use of

¹⁰Fireline is an area where vegetation is cleared in an effort to stop the fire’s spread at that point or slow it sufficiently to allow firefighters to attack directly. Firefighters often incorporate geographic features such as roads, rocky areas, or ridgelines into firelines to increase their effectiveness.

¹¹In the United States, vendors have traditionally chosen retired military bombers, transport, and patrol aircraft to convert to large airtankers due to their availability and relatively low cost.

¹²Some water scoopers are also capable of dropping suppressant foam, which is applied directly on fires to reduce their intensity.

¹³An operational period is the period of time scheduled for execution of a given set of tactical actions. Operational periods can be of various lengths, although usually not more than 24 hours.

additional firefighting resources; when such fires grow large and complex, these activities may be referred to as large fire support. Federal and state wildland fire responders rely on a tiered interagency dispatch process for requesting and coordinating the use of firefighting resources, including aircraft, to respond to wildland fires. For example, when a wildland fire is reported, a local dispatch center identifies and dispatches, if available, fire response resources such as firefighters, aircraft, and equipment to perform initial attack activities. If sufficient resources are not available, local dispatch centers can request additional resources from the appropriate geographic area coordination center.¹⁴ In the event that sufficient resources are not available within a geographic area, its geographic area coordination center can request additional resources from the National Interagency Coordination Center, which serves as the focal point for coordinating the mobilization of resources for wildland fire and other incidents throughout the United States.¹⁵

A number of interagency organizations develop interagency firefighting standards, including those pertaining to the development and use of firefighting aircraft, and coordinate federal firefighting efforts. To coordinate the overall firefighting efforts of the Forest Service and other federal land management agencies, the interagency National Wildfire Coordinating Group was established in 1974.¹⁶ This interagency group develops and maintains standards, guidelines, and training and certification requirements for interagency wildland fire operations. Within this group, the National Interagency Aviation Committee is an interagency body of federal and state aviation operations managers responsible for providing common policy and direction for aviation resources involved in wildland firefighting.¹⁷ This committee was established to serve as a body

¹⁴Eleven regional dispatch centers, called geographic area coordination centers, are located nationwide, each of which serves a specific geographic portion of the United States.

¹⁵The National Interagency Coordination Center is located at the National Interagency Fire Center in Boise, Idaho.

¹⁶The National Wildfire Coordinating Group draws on representatives from the Forest Service and from Interior's Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service, as well as the U.S. Fire Administration, National Association of State Foresters, and Intertribal Timber Council.

¹⁷Prior to April 2010, the National Interagency Aviation Committee was known as the National Interagency Aviation Council. We refer to the organization as the National Interagency Aviation Committee throughout this report.

of aviation experts, assisting the National Wildfire Coordinating Group with recognizing opportunities to enhance safety, effectiveness, and efficiency in aviation-related operations, procedures, programs, and coordination. In turn, the National Interagency Aviation Committee chartered the Interagency Airtanker Board to review and approve retardant and water delivery systems based on established performance criteria. The approval process—which includes an assessment of system design, testing of the systems' performance, and a physical inspection of the aircraft with system installed—ensures that the systems meet basic standards for delivery of retardant or water. Interagency Airtanker Board approval serves as a guide to participating federal and state agencies for identifying acceptable aircraft and retardant or water delivery systems that may compete for agency contracts.

The federal firefighting aircraft fleet includes some aircraft that are government owned, but most are obtained through contracts with private industry vendors. For example, the federal government owns some surveillance and smokejumper aircraft and contracts for the remainder, along with helicopters and aircraft that deliver retardant or water, from private industry vendors that own, operate, and maintain them. Currently, the Forest Service issues contracts for large and very large airtankers, as well as large and medium helicopters, and Interior issues contracts for single-engine airtankers and water scoopers.¹⁸ The agencies use two types of contracts for obtaining firefighting aircraft from vendors: exclusive-use and call-when-needed.¹⁹ Exclusive-use contracts require a vendor to provide an aircraft for service on any day covered by the "mandatory availability period" stipulated in the contract. The agencies pay vendors a daily rate regardless of whether the aircraft is used and also pay a fee for each hour flown if the aircraft is used. Conversely, call-when-needed contracts do not guarantee vendors any fee unless the aircraft is called upon to provide aerial fire support. This type of contract allows the government the flexibility to pay for firefighting aircraft only when they are used. However, the daily availability and flight hour rates for call-when-needed contracts are generally higher than those for

¹⁸Both agencies contract for small helicopters as well as smokejumper and surveillance aircraft.

¹⁹Forest Service uses the term "call-when-needed," and Interior uses the term "on-call" for contracts in which the agencies guarantee payment to the vendor contingent upon the aircraft being used. For the purposes of this report, we use the term call-when-needed to describe all such contracts.

exclusive-use contracts. In contrast to large airtankers, other types of firefighting aircraft are generally more available for federal contracting. For example, the agencies plan to have over 100 helicopters available in 2013 for fire suppression activities through exclusive-use contracts with hundreds more available through call-when-needed contracts. See appendix II for the number and types of aircraft in the federal firefighting aircraft fleet in 2013 and their associated cost rates.

The Forest Service and Interior have also established agreements with other governments (i.e., cooperator governments), as well as the military, to augment the national firefighting aircraft fleet during periods of heavy fire activity. The United States and Canada have established a mutual aid agreement whereby the National Interagency Coordination Center and the Canadian Interagency Forest Fire Centre can request firefighting resources, including aircraft, from each other during periods of heavy fire activity.²⁰ Similarly, some U.S. states and Canadian provinces have established regional intergovernmental agreements to facilitate the sharing of firefighting resources: the Northwest Fire Protection Agreement,²¹ the Great Lakes Forest Fire Compact,²² and the Northeastern Forest Fire Protection Compact.²³ Through these agreements, firefighting resources, including aircraft, can be dispatched from their contracted agency, state, or province to assist on fires on other lands covered by the agreement. The Forest Service can also obtain aerial firefighting support through the Modular Airborne Firefighting System (MAFFS) program under an agreement with DOD. Under this program, DOD provides Lockheed Martin C-130 Hercules aircraft as additional capacity for aerial firefighting when requested by the Forest Service. Each of the aircraft is equipped with a MAFFS unit—a portable,

²⁰Canada / United States Reciprocal Forest Fire Fighting Arrangement (May 7, 1982). The arrangement is implemented in a series of annual operating plans, the most recent of which was issued on January 15, 2013.

²¹Signatories to the Northwest Fire Protection Agreement include the states of Alaska, Idaho, Montana, Oregon, and Washington, as well as the Canadian provinces of Alberta, British Columbia, and the Northwest and Yukon Territories.

²²Members of the Great Lakes Forest Fire Compact include the states of Michigan, Minnesota, and Wisconsin, as well as the Canadian provinces of Manitoba and Ontario.

²³Signatories to the Northeastern Forest Fire Protection Compact include the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont, as well as the Canadian provinces of New Brunswick, Newfoundland and Labrador, Nova Scotia, and Quebec.

pressurized retardant delivery system that can be inserted into military C-130 aircraft to convert them into large airtankers when needed. The Forest Service owns the MAFFS units (eight in total) and provides the retardant, and DOD provides the C-130 aircraft, pilots, and maintenance and support personnel to fly the missions.²⁴ A new generation of MAFFS units became operational in February 2009, and the fleet has since transitioned to use this system exclusively.

Agencies' Efforts to Identify Firefighting Aircraft Needs Have Been Hampered by Limited Information and Collaboration

Since 1995, the Forest Service and Interior have cumulatively produced nine major studies and strategy documents related to their firefighting aviation needs, but the agencies' efforts to identify the number and type of firefighting aircraft needed have been hampered by limited information and collaboration. In particular, these efforts did not include information on the performance and effectiveness of firefighting aircraft and involved limited collaboration between agencies and with stakeholders in the fire aviation community.

Agency Efforts to Identify Firefighting Aircraft Needs Did Not Include Information on Performance and Effectiveness of Firefighting Aircraft

Forest Service and Interior efforts to identify the number and type of firefighting aircraft they need have largely consisted of developing major studies and strategy documents—nine since 1995. Based on reviews of academic and government studies and interviews with officials and representatives from across the fire aviation community, we identified the following key elements as important for understanding firefighting aircraft needs:

- Aircraft types – aircraft manufacturer, model, and size classification;
- Basing options – potential locations for aircraft bases;
- Acquisition models – options for obtaining aircraft, including purchasing aircraft or using vendor-owned aircraft;
- Aircraft capabilities – required capabilities of aircraft, such as retardant capacity and speed;
- Suppression methods – how to use aircraft to suppress fire, including initial attack and extended attack; and
- Aircraft performance and effectiveness – the results of using aircraft to support fire suppression activities.

²⁴These aircraft are operated by Air National Guard units in California, North Carolina, and Wyoming, as well as an Air Force Reserve unit in Colorado.

While the Forest Service and Interior studies and strategy documents contained various key elements, none included information on performance and effectiveness of aircraft in helping to suppress wildland fires because agencies have not collected such information. Figure 2 identifies which key elements were included in each of the major studies and strategy documents we analyzed. (See app. III for additional information on each of these efforts.)

Figure 2: Key Elements Included in Major Forest Service and Interior Efforts Since 1995 to Identify Number and Type of Firefighting Aircraft They Need

Title of effort	Author(s)	Year	Key elements					
			Aircraft types	Basing options	Acquisition models	Aircraft capabilities	Suppression methods	Aircraft performance and effectiveness
National Study of Airtankers to Support Initial Attack and Large Fire Suppression: Phase 1	Forest Service and Interior	1995	●	●				
National Study of (Large) Airtankers to Support Initial Attack and Large Fire Suppression: Phase 2	Forest Service and Interior	1996	●	●	●	●		
National Study of Tactical Aerial Resource Management to Support Initial Attack and Large Fire Suppression	Forest Service and Interior	1998	●	●	●	●	●	
Wildland Fire Management Aerial Application Study ^a	Fire Program Solutions, LLC ^b	2005	●	●	●	●	●	
Management Efficiency Assessment on Aviation Activities in the USDA Forest Service	Management Analysis, Incorporated ^b	2008	●	●				
National Interagency Aviation Council Interagency Aviation Strategy ^c	National Interagency Aviation Council	2009	●	●	●	●	●	
Forest Service Large Airtanker Modernization Strategy	Forest Service	2012	●		●	●		
Air Attack Against Wildfires: Understanding U.S. Forest Service Requirements for Large Aircraft	Rand Corporation ^b	2012	●					
Firefighting Aircraft Study	Avid LLC ^d	2013		●				

Source: GAO analysis of agency efforts.

Note: Other studies of firefighting aviation have been published but are not included here because they did not include efforts to identify the appropriate number or type of firefighting aircraft. See, for example, Blue Ribbon Panel, Federal Aerial Firefighting: Assessing Safety and Effectiveness (December 2002).

^aThe 2005 Wildland Fire Management Aerial Application Study is the third phase of the National Study of Airtankers to Support Initial Attack and Large Fire Suppression.

¹The Forest Service contracted a private company to conduct this study.

²As previously noted, the National Interagency Aviation Council became known as the National Interagency Aviation Committee in April 2010. The Forest Service, Interior, Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, National Park Service, and National Association of State Foresters participate in the National Interagency Aviation Committee and assisted in developing this strategy.

The agencies generally used cost- and efficiency-based metrics in these efforts, such as the potential cost of damage from wildland fires or the frequency with which requests for firefighting aircraft are unmet, to identify their firefighting aircraft needs. For example, the three-part *National Study of Airtankers to Support Initial Attack and Large Fire Suppression*, conducted from 1995 to 2005, estimated the number of large airtankers needed by comparing the cost of using large airtankers to help suppress wildland fires with the projected cost of the damage that could result from not suppressing the fires. In addition, the Forest Service's 2013 *Firefighting Aircraft Study* focused on efficiency and identified the number of large airtankers needed by analyzing the annual number of requests for these aircraft that the Forest Service was unable to meet.²⁵ However, agency efforts to identify their firefighting aircraft needs have not included information on the performance and effectiveness of using aircraft to suppress wildfires primarily because neither the Forest Service nor Interior has collected data on these aspects of firefighting aircraft. Specifically, the agencies have not established data collection mechanisms to track the specific tactical uses of firefighting aircraft—for example, where retardant or water is dropped in relation to a fire as well as the objective of a drop, such as protecting a structure or preventing a fire from moving in a specific direction—or measure their performance and effectiveness in those uses. Moreover, a 2012 study by the Forest Service's Rocky Mountain Research Station found that the Forest Service did not collect information about the locations where airtankers drop retardant or the actual performance and effectiveness of these aircraft.²⁶

²⁵Specifically, this study analyzed requests submitted by incident commanders or other firefighting officials seeking firefighting aircraft support on individual fires. Such requests are entered into an agency resource ordering system, which tracks the number of filled and unfilled requests. The study also analyzed the number of unfilled requests for large helicopters, but it did not identify the number of large helicopters needed.

²⁶Matthew P. Thompson, David E. Calkin, Jason Herynk, Charles W. McHugh, and Karen C. Short, "Airtankers and Wildfire Management in the US Forest Service: Examining Data Availability and Exploring Usage and Cost Trends," *International Journal of Wildland Fire* (August 2012).

In May 2012, we reported on the importance of performance information in another context and found that such information can inform key management decisions, such as allocating resources, or it can help determine progress in meeting the goals of programs or operations.²⁷

General agreement exists among wildland firefighters that, based on their experience, using aircraft can be beneficial to suppressing fires, but little empirical data exist to measure the performance and effectiveness of such aircraft use. For example, a 2007 study cited anecdotal evidence that firefighting aircraft saved homes, and a 2012 study that surveyed fire management officials found that these officials believed aircraft were effective in reducing the amount of time required to contain wildfires, particularly in the most difficult fire suppression conditions.²⁸ However, such views are not based on empirical data on aircraft performance and effectiveness, and other studies—including the Forest Service's 2013 *Firefighting Aircraft Study*—found that no accurate information on the effectiveness of aerial fire suppression exists and noted that the factors contributing to the success of wildfire suppression efforts are poorly understood.²⁹ Further, the 2009 *Interagency Aviation Strategy* stated it is difficult to assess the relative value of delivering retardant or water through helicopters, large airtankers, and single-engine airtankers and called for analytic tools focusing on this area to be developed. In addition, the 1998 *National Study of Tactical Aerial Resource Management* identified the need for better information on the intended use of surveillance aircraft—such as support for initial attack or large fire suppression activities—to determine the specific types of aircraft that will meet federal needs for aerial surveillance during firefighting.

²⁷GAO, *Nanotechnology: Improved Performance Information Needed for Environmental, Health, and Safety Research*, GAO-12-427 (Washington, D.C.: May 21, 2012).

²⁸See M. Plucinski, J. Gould, G. McCarthy, and J. Hollis, "The Effectiveness and Efficiency of Aerial Firefighting in Australia, Part 1," Bushfire Cooperative Research Centre, Technical Report A0701 (June 2007), and M. Plucinski, J. McCarthy, J. Hollis, and J. Gould, "The Effect of Aerial Suppression on the Containment Time of Australian Wildfires Estimated by Fire Management Personnel," *International Journal of Wildland Fire* 21 (December 2011): 219-229.

²⁹See, for example, Avid, LLC, "Firefighting Aircraft Study," AG-024B-C-12-0006 (Yorktown, VA: Feb. 27, 2013) and Mark A. Finney, Isaac C. Grenfell, and Charles W. McHugh, "Modeling Containment of Large Wildfires Using Generalized Linear Mixed-Model Analysis," *Forest Science*, 55, no. 3, (June 2009): 249-255.

This limited availability of information on the performance and effectiveness of firefighting aircraft is an area of long-standing concern; since the 1960s, multiple reviews of federal fire aviation programs have called for the Forest Service and Interior to collect information on the performance of firefighting aircraft but neither agency has taken action until recently.³⁰ Specifically, in May 2012, the Forest Service recognized the need for an approach to evaluate the effective and efficient use of firefighting aircraft and began a project on aerial firefighting use and effectiveness to develop technology, evaluation criteria, and performance measures to quantify and assess the effective use of large airtankers, helicopters, and water scoopers in delivering retardant, water, and fire-suppressing chemicals.³¹ According to Forest Service documents, the agency plans to collect information including whether an aircraft was used for initial attack or extended attack; the aircraft's objective, such as building a line of retardant, directly suppressing fire, or protecting a specific structure; whether the fire is in grass, shrub, or timber; general weather conditions; and characteristics of the actual drop of retardant, such as the time, aircraft speed, retardant amount, and outcome.³² The agency collected some of this information during 2012, but it has not developed incremental goals for assessing progress or timelines for completing the project.

The Forest Service faces several challenges in carrying out its project on aerial firefighting use and effectiveness. For example, during 2012, the agency collected information on the performance and effectiveness of one type of aircraft—large airtankers—from about 25 fires but needs information on several hundred fires to perform useful analysis on large airtanker performance, according to Forest Service officials managing the data collection effort. These officials said that it will likely take several years for the agency to collect the information needed to analyze and

³⁰See, for example, Forest Service, *Airtanker Retardant Drop Evaluation Study*, 1964, and Department of Agriculture Office of Inspector General, *Audit Report: Forest Service's Replacement Plan for Firefighting Aerial Resources*, 08601-53-SF (Washington, D.C.: July 16, 2009).

³¹The working title of this project is the *Aerial Firefighting Use and Effectiveness Study*.

³²The Forest Service plans to collect this information by using existing processes, such as gathering reports from aerial firefighters who observe aircraft dropping retardant or water to suppress fires. Forest Service officials told us that the agency also uses non-traditional processes to collect information, such as infrared imagery, ground photos, and aircraft tracking sensors.

understand the effectiveness of the three types of firefighting aircraft—large airtankers, helicopters, and water scoopers—included in the project. Forest Service officials also told us that aerial firefighters have been reluctant to collect information on the results of using firefighting aircraft for several reasons, including safety concerns regarding adding to the workload of aerial firefighters while they are flying over fires, firefighters' concerns that Forest Service will use the information to criticize their performance, a firefighting culture that values experience and history over data and scientific analysis, and the challenges in finding time to complete data collection while fighting wildfires. Interior officials said that the department is assisting the Forest Service in this data collection project but does not currently have plans to collect performance information on the firefighting aircraft it manages.

Large airtankers have been the focus of the Forest Service's current data collection effort as well as the agencies' prior studies and strategy documents, but few efforts have focused on other types of firefighting aircraft. Specifically, eight of the agencies' nine studies and strategy documents attempted to identify the appropriate number of large airtankers for the federal fleet. However, only three of the efforts—the 1998 *National Study of Tactical Aerial Resource Management*, the 2009 *Interagency Aviation Strategy*, and the 2012 *Air Attack Against Wildfires: Understanding U.S. Forest Service Requirements for Large Aircraft*—identified the number of other types of aircraft needed,³³ despite the fact that each type of firefighting aircraft provides unique capabilities to support fire suppression operations. For example, water scoopers can deliver large quantities of water when a fire ignites near a water source, smokejumper aircraft can quickly transport firefighters and supplies to fires in remote areas, and helicopters have the versatility to transport firefighters, supplies, or small quantities of water or retardant. As a result, performance and effectiveness information on all types of firefighting aircraft helps agencies identify the number and type of firefighting aircraft they need, including assessing any potential new firefighting aircraft platforms or technologies that vendors may propose; understand the strengths and limitations of each type of aircraft in different situations; and understand how firefighting aircraft could help achieve their wildfire

³³The 1998 study recommended the appropriate number of surveillance aircraft, the 2009 study recommended the appropriate number for all aircraft types, and the 2012 study recommended the appropriate number of large airtankers, large helicopters, and water scoopers.

suppression goals. Obtaining information about aircraft performance and effectiveness could better inform agency estimates of firefighting aircraft needs to include in their strategies for obtaining aircraft, thus helping agencies better ensure the adequacy of the federal firefighting aircraft fleet.

In contrast to U.S. federal agencies, some foreign and U.S. state governments that operate aerial firefighting programs have employed various methods to collect and use performance and effectiveness information on their firefighting aircraft.³⁴ For example, in Canada, the British Columbia Forest Service requires aerial firefighters to complete an airtanker data report immediately after each airtanker flight. Officials then compile information gathered through these reports with information from their dispatch system to evaluate airtanker performance using a set of key performance indicators, such as the amount of time from the initial report of a fire to the time that an airtanker request is entered into the dispatch system, the distance between available airtankers and the actual fire, and the change in the size of the fire from the time an aircraft arrives at the fire to the time the fire is contained. According to British Columbia Forest Service officials, the performance information and indicators have been integral to improving British Columbia's aerial firefighting program. For example, officials found that available aircraft were often over 100 miles from the wildfires where they dropped retardant. Based on this analysis, the province made significant changes to its methods for pre-positioning firefighting aircraft and as a result, available aircraft are generally within 60 miles of a wildfire. In addition, the Minnesota Department of Natural Resources requires officials to complete debriefing reports after each use of firefighting aircraft. The report includes information on the specific aircraft that were sent to the fire and gathers the firefighters' views on whether areas such as dispatch information, aircraft briefings, target descriptions, and communications were adequate or need improvement. According to Minnesota Department of Natural Resources officials,

³⁴In the United States, numerous state governments operate aerial firefighting programs of varying sizes that use numerous types of aircraft. Of the state officials we met with—representing Alaska, California, Florida, Minnesota, New Hampshire, and Texas—Minnesota state government officials reported collecting aircraft performance information. While several foreign governments—including Australia, multiple Canadian provinces, France, and Italy—operate aerial firefighting programs, we spoke to British Columbia province officials because the Forest Service identified British Columbia's collection and use of airtanker performance information as a leading practice.

information from these reports may help determine the best methods for suppressing fires when a specific set of aircraft is available.

Agencies Have Not
Consistently Collaborated
with One Another or with
Other Stakeholders to
Identify Firefighting
Aircraft Needs

In efforts to identify the number and type of firefighting aircraft they need, agencies have engaged in limited collaboration with one another or with other stakeholders in the fire aviation community. For example, the Forest Service developed its 2012 *Large Airtanker Modernization Strategy* without obtaining input from representatives of state fire aviation programs or the large airtanker industry and did not coordinate with Interior until after the development of an initial draft. According to several agency officials we spoke with, the Forest Service did not invite Interior officials to provide their input on the strategy until after the agency sent the draft version to the Office of Management and Budget (OMB) for review and approval. Similarly, regarding Interior, senior Interior officials told us that Interior generally does not involve other agencies or stakeholders in developing annual estimates of the number of each type of aircraft to obtain through contracts. Rather, Interior develops these estimates by asking relevant Interior bureaus to provide the number of each type of aircraft it needs, compiling these estimates, and adjusting them based on available funding.

The importance of collaboration with stakeholders and agencies has been noted in several government reports.³⁵ For example, the interagency 2009 *Quadrennial Fire Review* identified the need to engage agency leaders, partners, and industry in a strategic dialogue about the demands for firefighting resources, such as aircraft, and noted the importance of innovative and efficient ways to meet those demands.³⁶ Additionally, a 2009 Department of Agriculture Inspector General's report recommended that the Forest Service collaborate with stakeholders in the fire aviation

³⁵The importance of collaboration was noted in a 2002 report by an expert panel that Forest Service and Interior convened to examine the safety and effectiveness of federal aerial firefighting. This report identified collaboration among agencies, contractors, and states as possibly the single largest aerial firefighting challenge facing federal agencies at the time. See Blue Ribbon Panel, *Federal Aerial Firefighting: Assessing Safety and Effectiveness* (December 2002).

³⁶The Quadrennial Fire Review is a strategic assessment process that is conducted every 4 years to evaluate current mission strategies and capabilities against best estimates of the future environment for wildfire management. This integrated review is a joint effort of the five federal natural resource management agencies and their state, local, and tribal partners that constitute the wildland fire community.

community to develop goals and performance measures for the agency's aviation strategic plan.³⁷ Regarding collaboration with stakeholders, in April 2013, we reported that when agencies carry out activities in a fragmented and uncoordinated way, the resulting patchwork of programs can waste scarce funds, confuse and frustrate program customers, and limit the overall effectiveness of the federal effort.³⁸ In addition, we reported in October 2011 that successful organizations involve stakeholders in developing their mission, goals, and strategies to help ensure that they target the highest priorities.³⁹ In that report, we also stated that stakeholders can influence success or failure of agencies' programs.

Many Forest Service and Interior officials, as well as other stakeholders, we spoke with expressed concerns about limited collaboration, and many cited shortcomings with the formal mechanism for interagency collaboration—the National Interagency Aviation Committee, which includes representatives from the Forest Service, Interior and its bureaus, and the National Association of State Foresters. Some stakeholders told us the committee has not always considered the needs of all agencies involved in firefighting efforts. For example, in 2008 committee members collaboratively developed a national firefighting aviation strategy, the *Interagency Aviation Strategy*. A year later, however, the Forest Service developed an appendix to the strategy that outlined the Forest Service's plans for replacing its large airtanker fleet, and the committee published an amended strategy—including that appendix—without providing member agencies the opportunity to review or contribute to it, according to agency officials. As a result, the large airtanker appendix does not reflect the opinions of all committee members, and consequently does not reflect the needs of the fire aviation community stakeholders that will require the use of large airtankers. In addition, Forest Service and Interior officials told us that agency staff who serve on the committee are generally firefighting operations staff and do not represent senior agency

³⁷Department of Agriculture Office of Inspector General, *Audit Report: Forest Service's Replacement Plan for Firefighting Aerial Resources* (Washington, D.C.: July 16, 2009).

³⁸GAO, *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, GAO-13-279SP (Washington, D.C.: Apr. 9, 2013).

³⁹GAO, *Environmental Justice: EPA Needs to Take Additional Actions to Help Ensure Effective Implementation*, GAO-12-77 (Washington, D.C.: Oct. 6, 2011).

management. As a result, the collaboration that occurs through the committee is often limited to day-to-day operations activities rather than broader strategic efforts.

The committee has implemented some leading practices that we previously reported can help enhance and sustain collaboration.⁴⁰ Specifically, the committee's members have defined and articulated a common purpose and have agreed on agency roles and responsibilities. For example, the committee's charter identifies its purpose as serving as a body of aviation experts focused on identifying opportunities to enhance safety, effectiveness, and efficiency in aviation related operations, procedures, programs, and coordination. In addition, the committee's 2009 *Interagency Aviation Strategy* defines the general aerial firefighting roles and responsibilities of federal and state agencies as well as aircraft contracting responsibilities of the Forest Service and Interior. However, we previously found that agencies often face a range of barriers, including concerns about controlling jurisdiction over missions and resources, when they attempt to collaborate with other agencies.⁴¹ Interior officials told us that the division of firefighting aircraft contracting responsibilities among the Forest Service and Interior—under which Forest Service issues contracts for large and very large airtankers and large and medium helicopters, while Interior issues contracts for single-engine airtankers and water scoopers—may not foster a culture of collaboration since each agency is focused on its own aircraft of responsibility. Although the committee has implemented some leading practices for collaboration, it has not taken additional steps to reinforce agency accountability for collaboration, such as developing mechanisms to monitor, evaluate, and report the results of collaborative efforts.⁴² We have reported that by creating the means to monitor, evaluate, and report the results of their collaborative efforts, federal agencies can better identify areas for improvement, although the specific ways in which this practice is implemented may differ based on the specific collaboration challenges agencies face. For example, mechanisms for monitoring the results of collaborative efforts may range from occasional meetings among agency officials to more formal periodic reviews where officials from each agency

⁴⁰GAO-06-15.

⁴¹GAO, *Managing for Results: Barriers to Interagency Coordination*, GAO/IGD-00-106 (Washington, D.C.: Mar. 29, 2000).

⁴²GAO-06-15.

report on progress toward achieving the goals of interagency collaborative efforts. As we reported in August 2012, absent effective collaboration, interagency efforts could result in limited information being communicated and opportunities for incorporating stakeholder input being missed.⁴³

Senior management in both the Forest Service and Interior told us they have begun discussions regarding how to improve their interagency collaboration. However, they said that these discussions have focused on obtaining firefighting aircraft for the 2013 fire season and have not yet addressed collaboration on strategic planning issues. Further, both Forest Service and Interior officials told us the *Interagency Aviation Strategy* is outdated and should be updated to more accurately reflect current firefighting aircraft needs. Engaging in effective collaboration to incorporate input from all fire aviation community stakeholders could better position the agencies in developing strategic planning documents—including any updates to the *Interagency Aviation Strategy*—that represent the national need for firefighting aircraft.

The Forest Service's Approach to Modernizing the Large Airtanker Fleet Faces Challenges, Resulting in Uncertainty over Continued Large Airtanker Availability

The Forest Service plans to modernize the large airtanker fleet by obtaining large airtankers from various sources over the near, medium, and long terms, but each component of this approach faces challenges that make the continued availability of such aircraft to meet national fire suppression needs uncertain. The components of the agency's approach include: (1) in the near term, continuing to contract with private vendors for "legacy" large airtankers—generally aging aircraft with limited future service life spans—on exclusive-use contracts and very large airtankers on call-when-needed contracts, as well as relying on agreements with cooperator governments and the military; (2) in the medium term, contracting with vendors for airtankers that are more modern and capable than those generally in use currently; and (3) in the long term, acquiring new federally-owned aircraft with expected service life spans of up to 30 years. Additionally, some federal and state agencies are considering alternative plans to obtaining aerial fire suppression support to reduce reliance on large airtankers.

⁴³GAO, *Housing Assistance: Opportunities Exist to Increase Collaboration and Consider Consolidation*, GAO-12-554 (Washington, D.C.: Aug. 16, 2012).

The Forest Service's
Near-term Approach
Includes Using "Legacy"
and Supplemental
Airtankers but Concerns
Exists Regarding Aircraft
Availability, Performance,
or Cost

For the near-term, the Forest Service plans to primarily rely on exclusive-use "legacy" contracts to obtain large airtankers. However, during periods of heavy fire activity, the agency plans to obtain supplemental airtankers through call-when-needed contracts for very large airtankers, agreements with cooperator governments, and military aircraft equipped with MAFFS. However, agency officials and vendor representatives told us about limitations and challenges—including availability, performance, and cost—regarding these resources.

"Legacy" Large Airtankers

Over the next 5 years—including the 2013 fire season—the Forest Service plans to rely on aircraft obtained through its "legacy" exclusive-use contracts, which has been the agency's traditional acquisition model for obtaining large airtankers. The agency in 2013 announced contract awards for nine aircraft: seven P-2V Neptunes—Korean War-era piston-engine maritime patrol aircraft—and two British Aerospace BAe-146s—converted versions of modern commercial jets.⁴⁴ However, the availability of the P-2V Neptunes in the short term is uncertain, and the Interagency Airtanker Board has documented concerns regarding performance of the retardant delivery systems on these BAe-146s.

- *Lockheed P-2V Neptune.* The age of the seven P-2V Neptunes—they average more than 50 years old—makes their availability throughout the entire 5-year contract period uncertain. Specifically, vendors told us they might need to retire some aircraft prior to the end of the current contract period because of the cost of maintaining the aging aircraft. In particular, they told us that the limited availability of replacement parts—and the difficulty of manufacturing new ones if no others exist—coupled with the requirements of increased maintenance and inspection standards make the P-2V Neptune difficult to operate in a cost-effective manner. Further, physical stresses on the aircraft could cause cracking of critical components during fire missions. For example, representatives from Neptune Aviation Services told us that the vendor retired one of its P-2V

⁴⁴These contracts were awarded to two vendors: Neptune Aviation Services (six P-2V Neptunes and two BAe-146s) and Minden Air Corp (one P-2V Neptune). The Forest Service initially awarded a contract for a single BAe-146, but added another based on concerns regarding the overall availability of large airtankers for the 2013 fire season. The P-2V Neptunes are capable of delivering approximately 2,000 gallons of retardant and the BAe-146s approximately 2,600 gallons.

Neptunes after the 2012 fire season due to structural problems discovered during routine maintenance.⁴⁵ They also said that the vendor probably could continue to operate approximately five P-2V Neptunes for the next 10 years but that the current heavy use of their fleet could shorten this timeframe. Ultimately, Neptune Aviation Services plans to retire its P-2V Neptune fleet and transition to operating modern aircraft exclusively.

- *Neptune Aviation Services' British Aerospace BAe-146s.* Concerns regarding the performance of the retardant delivery system on Neptune Aviation Services' BAe-146s have been documented during agency evaluations of the aircraft and were voiced by several agency officials we interviewed.⁴⁶ During initial assessment of the system in 2011, the Interagency Airtanker Board determined that the retardant delivery system did not meet established performance criteria and identified problems regarding the system's design and performance.⁴⁷ However, in September 2012, the board approved, on an interim basis, the use of the retardant delivery system through the 2012 fire season so that information on its operational effectiveness could be collected and design deficiencies addressed. During the 2012 fire season, the BAe-146s collectively made approximately 300 retardant drops, which the board considered sufficient to collect data needed to assess their operational effectiveness.

In December 2012, the Interagency Airtanker Board declined to extend the interim approval of Neptune Aviation Services' BAe-146 system, citing the problematic retardant delivery system design and deficient performance during the 2012 fire season. In February 2013, however, the National Interagency Aviation Committee determined that the need for aircraft to deliver retardant for the 2013 fire season was sufficiently important to override the board's decision. As a result,

⁴⁵Representatives of Minden Air Corp told us that the company no longer operates one of its two P-2V Neptunes following damage sustained from a controlled-crash landing caused by landing gear failure during the 2012 fire season.

⁴⁶The retardant delivery system of this specific BAe-146 differs from traditional systems; it uses a series of tubes to evacuate retardant from the aircraft rather than doors.

⁴⁷Specifically, this initial assessment determined that the system did not have the range of variability of retardant flow rates normally found in proposed systems, the consistency of retardant flow trailed off as the retardant tank emptied, and the system was unable to predictably drop retardant while in a nose-down descent—a common flight profile for dropping retardant downhill.

	the board, at the direction of the committee, granted an extension of its interim approval of the retardant delivery system through December 15, 2013. Representatives of Neptune Aviation Services acknowledged that the system has limitations, but they stated that the company is developing a revised retardant delivery system and plans to retrofit all of its BAe-146 aircraft with the updated design by the beginning of the 2014 fire season. However, the Interagency Airtanker Board has noted that the deficiencies may persist due to the inherent design of the system, and fire management officials from the Forest Service, Interior, and several states that are familiar with this aircraft told us they have reservations about the retardant delivery system's performance.
Very Large Airtankers	The Forest Service announced call-when-needed contracts for two very large airtankers—converted versions of Boeing 747 and McDonnell Douglas DC-10 commercial jets—to provide extended attack and large fire support beginning in 2013 with durations of up to 3 years. However, some agency officials cited concerns about the aircrafts' role, suitability for operating over rugged terrain, limited compatibility with current airtanker base infrastructure, and high costs (see fig. 3 for an example of a very large airtanker).⁴⁸

⁴⁸Two vendors developed very large airtankers during the early 2000s, with each retrofitting a different type of aircraft—10 Tanker Air Carrier converted two McDonnell Douglas DC-10s with retardant capacities of 11,600 gallons, and Evergreen International Aviation converted a Boeing 747 with a retardant capacity of 19,400 gallons.

Figure 3: Example of a DC-10 Very Large Airtanker Dropping Retardant



Source: 10 Tanker Air Carrier.

The Forest Service previously contracted for very large airtankers, but according to Forest Service and Interior officials, firefighters were initially reluctant to request the very large airtankers for several reasons. For example, because of the size of these aircraft, some federal officials were uncertain whether they could safely operate in rugged terrain.⁴⁹ Some officials also told us that firefighters did not request very large airtankers because they were uncertain how best to use this new tool. For example, the Forest Service identifies the primary mission of large airtankers as initial attack, whereas the solicitation for the very large airtanker call-when-needed contract stated that they will be used to provide support for

⁴⁹To evaluate the safety and utility of very large airtankers, in 2009 the Forest Service contracted with the National Aeronautics and Space Administration to conduct an operational test and evaluation of both types of very large airtanker. This evaluation concluded that the aircraft could probably operate with few restrictions over gently rolling terrain but that extra restrictions might be necessary in extremely steep or rugged terrain. *USFS Very Large Aerial Tanker Operational Test and Evaluation Summary Report*, March 2, 2009. Representatives from 10 Tanker Air Carrier, which operates the DC-10s, told us that their aircraft have successfully delivered retardant in rugged terrain since 2006.

Cooperator Government
Airtankers

extended attack on large fires—leading to uncertainty about the best tactics for employing them.⁵⁰ Despite early reluctance to use very large airtankers, officials noted increased reliance on these aircraft; nevertheless, some agency officials continue to disagree about the most effective role—initial attack or large fire support—for these aircraft as well as whether or not they are suited to operating above rugged terrain. Additionally, very large airtankers can operate out of a limited number of established airtanker bases because their weight and size are too great for some existing base infrastructure such as runways or aircraft parking areas. Specifically, about half of the large airtanker bases nationwide—35 of 67—are currently or potentially capable of supporting DC-10 operations, according to a Forest Service official;⁵¹ the 747's compatibility with bases is even more limited in that it can operate from approximately 12 locations, not all of which are airtanker bases. However, some agency officials told us that the speed of these aircraft can compensate for their limited compatibility with existing airtanker bases and associated increased distances that the aircraft might need to fly to respond to fires. Some officials also noted concerns about the high costs of using the aircraft. (See app. II for the current contract rates of firefighting aircraft.)

The Forest Service plans to request large airtankers from two cooperator governments—Canada and the State of Alaska—during periods of high fire activity but these aircraft may not always be available. Under an agreement originally established in 1982, the Forest Service plans to rely on five Convair CV-580 large airtankers—converted commercial aircraft with retardant capacities of 2,100 gallons—provided by Canadian provinces as additional resources when additional large airtankers are needed. Additionally, Forest Service officials told us that, under a separate agreement, the agency can also request use of three CV-580s contracted by the State of Alaska. However, the use of these airtankers to supplement the federal large airtanker fleet is contingent upon the cooperator governments making them available. For example, such airtankers might already be committed to suppressing fires, which could prevent them from being released to assist other governments.

⁵⁰Both very large airtanker vendors told us that their aircraft are capable of supporting initial attack operations.

⁵¹The potential ability of 21 airtanker bases to support DC-10 operations may be contingent upon the availability of mobile retardant loading equipment.

Modular Airborne Firefighting System (MAFFS)

As it has periodically done since the program's inception in the early 1970s, the Forest Service plans to rely on the military to provide surge aerial firefighting capacity through the deployment of up to eight MAFFS-equipped C-130 aircraft (see fig. 4 for an example of a MAFFS-equipped C-130).⁵² However, a number of officials from the Forest Service, Interior, and state fire agencies stated that MAFFS performance can be inadequate in some circumstances. For example, while a Forest Service official noted that the MAFFS system has been approved by the Interagency Airtanker Board, some federal and state fire aviation officials told us that the retardant line dispersed by the MAFFS system is generally narrower than firefighters prefer, which can either allow a fire to jump across the retardant line or necessitate an additional drop to widen the line, if another aircraft is available. Additionally, some officials said the system is unable to penetrate dense forest canopies, thereby preventing the retardant from being effective when used in heavy timber. However, some federal and state officials told us that MAFFS can be used effectively on rangeland where grasses are the predominant fuel type.

Further, some fire officials expressed concern regarding the limited experience that MAFFS crews may have in the fire aviation mission because they are not full-time aerial firefighters. A DOD accident investigation report conducted in response to a 2012 fatal crash of a MAFFS-equipped C-130H found that the limited total firefighting experience of the crew—in particular, the number of drops accomplished prior to the accident—was a contributing factor to the accident.⁵³ The report also stated that the crew's training did not include essential components—including training on local terrain conditions and congested airtanker base operations—necessary to conduct MAFFS operations in the region where the crash occurred. A Forest Service official involved in managing MAFFS training told us that the agency has updated the training to better incorporate such components.

⁵²The Forest Service is responsible, through the National Interagency Fire Center, for reimbursing DOD for the actual costs of MAFFS activation. DOD estimates the per-hour flight costs of MAFFS to be between about \$4,700 and \$8,000 dollars depending on the model of C-130 used, with variable daily availability costs depending on factors including the number of personnel required as well as the location of the activation. A Forest Service budget official told us that the combined reimbursements to DOD for MAFFS training and operational use from 2007 to 2012 totaled nearly \$87 million.

⁵³*United States Air Force Accident Investigation Board Report C-130H3, T/N 93-1458* (Oct. 27, 2012).

Figure 4: Example of MAFFS-equipped C-130



Source: U.S. Air Force.

Note: This figure depicts a MAFFS-equipped C-130 dropping water during training.

The Forest Service's
Medium-term Approach
Includes Contracting for
Newer Aircraft, but
Implementation Has
Been Delayed

For nearly 2 years, the Forest Service has attempted to award "next-generation" contracts with durations of 5 to 10 years to modernize the fleet with faster and more up-to-date large airtankers. However, these efforts have been delayed by bid protests, and it is uncertain when some vendors will complete federal approval and certification processes for their aircraft, which are necessary prior to use as airtankers on federal contracts. As a result, it is uncertain when the "next-generation" large airtankers will be available to support fire suppression activities. Additionally, private vendors that are developing the "next-generation" large airtankers told us that concerns regarding the consistency of the Forest Service's approach to fleet modernization have increased the difficulty of making business decisions and could affect the number of aircraft they will be able to provide to the government.

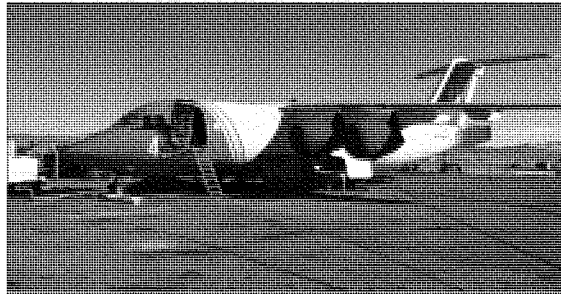
In November 2011, the Forest Service issued a solicitation for "next-generation" large airtankers in an effort to modernize the airtanker fleet

with more modern, capable, and safe large airtankers (see fig. 5).⁵⁴ In June 2012 the Forest Service issued an initial notice of intent to award contracts for seven aircraft. However, protests that challenged the announced awards were filed and consequently those contracts were not awarded. The Forest Service subsequently issued an amended solicitation, and in May 2013, the Forest Service announced contract awards for seven aircraft,⁵⁵ with the intent that these aircraft be available for use during the 2013 fire season. While the second round of "next-generation" large airtanker awards was also protested by a vendor, this protest was dropped in June 2013.

⁵⁴The "next-generation" large airtanker contract solicitation allowed for the award of up to seven exclusive-use contracts, each with up to five aircraft, with 5-year base durations followed by five 1-year option periods to be selected at the discretion of the Forest Service. It stipulated that candidate aircraft be turbine-powered, capable of cruising at speeds of at least 300 knots, and have a retardant capacity of at least 2,400 gallons, with a target capacity of 3,000 to 5,000 gallons. The solicitation indicated that aircraft with a capacity of 3,000 gallons or more would be evaluated higher than those aircraft offered with less capacity and would be considered first when determining awards. However, several vendors questioned the rationale behind the 3,000-5,000 gallon target, telling us that the aircraft available for the large airtanker mission with retardant capacities in the 2,000 to 2,500 gallon range may be more capable, available, and less expensive to operate.

⁵⁵Five vendors received contract awards for a total of seven aircraft. The seven aircraft were two Avro RJ85s, two McDonnell Douglas MD-87s, one BAe-146, one Lockheed Martin C-130Q, and one DC-10. All of these aircraft can carry between 3,000 and 5,000 gallons of retardant, according to Forest Service officials, with the exception of the DC-10, a very large airtanker capable of carrying 11,600 gallons. The DC-10 "next generation" contract flight hour rate includes the delivery of 5,000 gallons of retardant, although the aircraft can deliver its full capacity at a higher flight hour rate.

Figure 5: Example of a "Next-Generation" Large Airtanker (BAe-146)



Source: GAO.

Note: Minden Air Corp. owns this BAe-146 and is modifying it with the addition of a traditional gravity-fed retardant delivery system.

It is uncertain when all of the "next-generation" large airtankers will be available to support fire suppression activities because only one of these aircraft has completed necessary federal approval and certification processes. Specifically, the DC-10 very large airtanker has completed the Interagency Airtanker Board's approval process, which the Forest Service considers a prerequisite for delivering retardant in support of fire suppression activities. According to Forest Service officials, the remaining vendors originally scheduled the testing of their aircraft and retardant delivery systems for spring 2013. However, Forest Service officials also told us that, as of August 8, 2013, none of these aircraft had completed testing, which is now scheduled to continue later into the year. Additionally, they told us that only the DC-10 had received Federal Aviation Administration certification to be modified for operation as an airtanker, which is required by the Forest Service prior to aircraft delivering retardant.⁵⁶

⁵⁶Such approval is granted through a "supplemental type certificate," which is issued when a vendor has received Federal Aviation Administration approval to modify an aircraft from its original design.

Based on their experience with the Forest Service over the last several years, large airtanker vendors told us that they have a limited understanding of the agency's approach to fleet modernization. Specifically, they stated that the Forest Service has varied in the number and ownership structure (i.e., vendor, government, or a mix of the two) of large airtankers it plans to have in its fleet. As early as 2005, the Forest Service indicated it would rely on a fleet of government-owned Lockheed Martin C-130J Hercules aircraft, a substantial departure from the agency's longtime practice of relying on private vendors to supply firefighting aircraft. The 2009 *Interagency Aviation Strategy* called for a government-owned fleet of 25 new C-130Js and stated that the future federal use of privately-owned large airtankers was highly unlikely due to concerns regarding safety, cost, and aircraft availability. Yet the Forest Service's 2012 *Large Airtanker Modernization Strategy* stated that the agency will rely on private vendors to provide at least a portion of the intended large airtanker fleet, which it noted is likely between 18 and 28 aircraft.

Representatives of some large airtanker vendors we spoke with said that this inconsistency in the Forest Service's large airtanker approach has increased the difficulty of making business investment decisions. For example, some vendors told us that if they were confident that the Forest Service's long-term plans would include privately-owned large airtankers as a significant portion of its future large airtanker fleet, they might be more inclined to invest in the modification of additional aircraft. Some vendors also told us that a 10-year contract term—rather than the current practice of awarding contracts with 5-year base terms and five 1-year options—would create greater stability in the large airtanker market and could result in lower costs for the federal government by allowing vendors to recoup their aircraft investment costs over 10 years instead of 5.⁵⁷

⁵⁷The 2009 *Interagency Aviation Strategy* also identified the use of 10-year contracts as a goal for federal firefighting aircraft acquisition programs. However, Forest Service officials noted that the agency does not currently have the statutory authority to issue 10-year aviation contracts and that the 5-year duration of the "next generation" contracts is longer than the agency has typically issued.

Forest Service's Long-term Approach Includes Government-Owned Airtankers, but Concerns Exist Regarding Cost and Effectiveness	The Forest Service's 2012 Large Airtanker Modernization Strategy stated that the agency must continue to explore different acquisition models—including government-owned aircraft and vendor-owned aircraft under contract to the agency—to ensure the agency will have access to large airtankers over the long term. The strategy did not identify the agency's planned ratio of government-owned to vendor-owned aircraft, and Forest Service officials told us that such determinations have not yet been made. The strategy also did not specify the type of government-owned aircraft to be obtained, but a senior official in the Forest Service's Fire and Aviation Management program told us that the agency is planning to acquire a mix of Lockheed Martin C-130J Hercules and Alenia C-27J Spartan aircraft with expected service life spans of up to 30 years. However, potential acquisition or operational challenges are associated with both types of government-owned aircraft the Forest Service is proposing.
Lockheed Martin C-130J Hercules	While the Forest Service has indicated its long-term intention to rely on a government-owned fleet of C-130Js to meet some or all of its large airtanker needs,⁵⁸ the agency has been unable to demonstrate the feasibility of this approach to OMB, which would need to approve such an investment. The Forest Service estimates in its 2012 <i>Large Airtanker Modernization Strategy</i> that each new aircraft would cost \$79 million,⁵⁹ not including costs related to operations or maintenance.⁶⁰ Since 2005, the Forest Service has submitted two proposals for the government purchase of a large airtanker fleet to OMB for review and potential inclusion in budget requests. However, OMB officials told us that the agency rejected both of these proposals because they were incomplete and did not meet agency guidance.⁶¹ After reviewing these proposals, the Department of Agriculture's Office of Inspector General concluded in a 2009 audit report that the Forest Service needed to establish better

⁵⁸The Forest Service has also indicated that these would be used as multirole aircraft capable of transporting cargo and personnel when not in use as airtankers.

⁵⁹This represents a \$19 million increase over the \$60 million per-aircraft cost estimate stated in the Forest Service's large airtanker appendix to the 2009 *Interagency Aviation Strategy*.

⁶⁰Although the Forest Service proposed the acquisition of new C-130Js, a senior official told us the agency would also accept used C-130Js if they were declared surplus by DOD.

⁶¹Guidance on such submissions is contained in OMB Circular A-11, "Preparation, Submission, and Execution of the Budget" (August 2012), and OMB Circular A-126, "Improving the Management and Use of Government Aircraft" (May 22, 1992).

performance measures in coordination with interagency stakeholders and collect performance data on the use and effectiveness of airtankers.⁶² According to Forest Service officials, another proposal has been submitted for Department of Agriculture management review, but the department has not established a time frame for submitting the proposal to OMB. However, it is unclear whether the Forest Service has resolved the concerns of both OMB and the Inspector General. Additionally, Forest Service and Interior officials stated that the effectiveness of the C-130J will largely depend on the type of retardant delivery system installed. In particular, the officials expressed concern that equipping the aircraft with MAFFS-like units similar to those used in military C-130 aircraft—which the agency has indicated is an option—could be problematic given the previously discussed limitations of that type of retardant delivery system. In addition, obtaining such units could be problematic because there is no existing manufacturer of MAFFS units,⁶³ although the Forest Service issued a request for information from potential manufacturers regarding the development of new retardant delivery system designs.

Alenia C-27J Spartan

The Forest Service has also expressed interest in obtaining up to 14 Alenia C-27J Spartan transport aircraft from DOD if they are declared surplus equipment.⁶⁴ Forest Service documents indicate that the agency would benefit from acquiring these aircraft for several reasons. Specifically, agency documents cited that the C-27J aircraft would be safer and more reliable than “legacy” large airtankers, in part because they are newer and have improved structural designs; they could be used in multiple roles that include dropping retardant and carrying cargo or smokejumpers; their flight speed exceeds the 300-knot requirement under the “next-generation” contract; and the agency would not have to pay to acquire the aircraft—which officials described as a critical benefit—although it would incur costs to convert the aircraft to firefighting use.

Despite the advantages cited by the agency, several challenges may exist with operating the aircraft to support fire suppression activities,

⁶²Department of Agriculture Office of Inspector General, *Audit Report: Forest Service's Replacement Plan for Firefighting Aerial Resources* (Washington, D.C.: July 16, 2009).

⁶³The manufacturer of the MAFFS units used by DOD ceased operating in 2011.

⁶⁴A provision in the Fiscal Year 2013 National Defense Authorization Act grants the Forest Service preference over other agencies in acquiring seven of these aircraft for use in the firefighting mission if the aircraft are declared surplus by DOD.

including some related to the aircraft's capacity and capabilities. For example, an analysis conducted by a private consultant for the Forest Service indicated that the maximum retardant capacity of the C-27J is expected to be about 1,850 gallons, which is below the minimum 2,400 gallon retardant capacity the agency established for its "next-generation" large airtanker fleet.⁶⁵ Depending on how the aircraft are used, the actual capacity may be substantially lower. Specifically, the Forest Service has indicated that it would use the C-27Js as multirole aircraft, transporting cargo and smokejumpers when they are not being used as airtankers. To do so, the agency initially stated that it expected to rely on removable, pressurized retardant delivery systems similar to MAFFS units described earlier to allow the aircraft to carry out this multirole mission.⁶⁶ However, according to the Forest Service consultant, such a system would carry about 1,100 gallons. Some agency officials told us that they are concerned about the retardant capacity of the aircraft, particularly if a removable, pressurized delivery system is used. Specifically, they questioned whether the C-27J would be able to carry enough retardant to provide a useful resource to firefighters and noted that pressurized retardant delivery systems do not always provide adequate coverage on the ground to support fire suppression operations. More recently, Forest Service officials stated that the agency expects to use a removable, gravity-fed retardant delivery system rather than a pressurized system, which would likely alleviate some concerns regarding the system's capabilities. The agency stated that it is currently examining alternatives and will make a decision regarding the delivery system at the conclusion of that analysis.

Other potential challenges relate to uncertainties about the costs of operating and maintaining the aircraft, which the Forest Service would be responsible for under the 2013 National Defense Authorization Act. For example, the consultant hired by the Forest Service to analyze the C-27Js reported that, although there is a significant advantage in having the aircraft transferred without acquisition cost, the costs to maintain and

⁶⁵C-27J *Capabilities and Cost Analysis Report* (undated), submitted in October 2012 to the Forest Service by Convergent Performance, LLC.

⁶⁶The Chief of the Forest Service, in testimony before the Senate Committee on Appropriations, Subcommittee on Interior, Environment, and Related Agencies on May 22, 2013 and the Senate Committee on Energy and Natural Resources on June 4, 2013, stated that the agency was considering equipping any C-27Js obtained with MAFFS-like retardant delivery systems.

operate these aircraft are uncertain and could present challenges. A Forest Service official told us that the agency estimates the cost to modify each aircraft for the airtanker mission would range from \$1 million to \$4.25 million and delivery time frames would range from 6 months to 40 months, but the actual figures depend on the type of system selected.⁶⁷ Further, DOD officials responsible for managing the C-27J told us they expect the cost to maintain the aircraft to rise at the conclusion of DOD's current contract with a private vendor and stated that the Forest Service would need to establish new maintenance and training contracts, which could be complex to manage. According to both DOD officials and the Forest Service consultant's analysis, domestic flight training for this aircraft is available from a single provider, which the consultant indicated is "time consuming...and relatively expensive." Forest Service officials stated that they have not yet been able to access detailed information on DOD's experience with C-27J operations and maintenance costs and have not obtained information from the manufacturer to fully understand and analyze the costs of operating the aircraft.

Some Federal and State
Agencies Are Considering
Alternatives to Relying on
Federal Large Airtankers

Although the Forest Service has taken several steps to modernize the large airtanker fleet, as noted, the number of large airtankers available under federal contract decreased from 44 in 2002 to 8 in early 2013. As a result, some federal and state agencies are looking to alternative plans to suppress fires. For example, for the 2013 fire season, Interior increased the number of single-engine airtankers on exclusive-use contracts from 14 to 28 in part due to concerns about the availability of large airtankers. Interior officials noted that the use of single-engine airtankers has increased over the last decade as fewer large airtankers have been available. Interior also plans to rely on the capabilities of an additional 46 single-engine airtankers on call-when-needed contracts to provide additional support in 2013.⁶⁸ Following the termination of contracts for 8 large airtankers in 2011 due to safety concerns, the Forest Service has increased the number of large helicopters available on exclusive-use contract by 8, for a total of 34, from fiscal year 2011 to fiscal year 2012.

⁶⁷A Forest Service official told us that the agency estimates that the cost to refurbish and equip the aircraft for the smokejumper and cargo missions could be up to \$900,000 per aircraft.

⁶⁸Because these aircraft are not on exclusive-use contracts, their availability is not guaranteed.

Further, some states are taking actions to enhance their own abilities to obtain their own aerial firefighting support. For example, CAL FIRE officials told us that, as the result of concerns regarding the Forest Service's ability to consistently provide a large airtanker fleet to suppress fires in California, CAL FIRE may consider expanding its firefighting aircraft fleet to include large airtankers.⁶⁹ In the wake of similar concerns about aerial firefighting support for fires such as those that caused extensive damage in 2012,⁷⁰ Colorado has enacted legislation that authorizes a firefighting aircraft fleet for its state.⁷¹ In addition, Nebraska has enacted a bill that authorizes the state to contract for two single-engine airtankers.⁷²

Conclusions

Recognizing the importance of aircraft to help fight wildland fires, the Forest Service and Interior have undertaken efforts to identify the number and type of firefighting aircraft they need over the years but have met with limited success. None of the agencies' studies and strategy documents contained information on aircraft performance and effectiveness in supporting firefighting operations, which limits the agencies' understanding of the strengths and limitations of each type of firefighting aircraft and their abilities to identify the number and type of aircraft they need. The Forest Service has started to collect some aircraft performance information, but it is limited and focused on large airtankers. Interior has no current plans to collect performance information on the aircraft it manages. Agencies have also engaged in limited collaboration with each other and with other stakeholders in the fire aviation community—including the private aircraft vendors on whom the Forest Service has traditionally relied to provide large airtankers. Incorporating input from all fire aviation community stakeholders in their strategic planning documents could better position the Forest Service and Interior in developing estimates of aircraft needs to include in their strategies that

⁶⁹CAL FIRE operates and maintains 23 Grumman S-2T Tracker airtankers (former naval anti-submarine aircraft with retardant capacities of 1,200 gallons each), 16 North American-Rockwell OV-10 Bronco surveillance aircraft, and 11 Bell UH-1H Super Huey helicopters.

⁷⁰The 2012 Waldo Canyon and High Park fires cumulatively burned a total of 105,531 acres, cost nearly \$56 million to suppress, and destroyed at least 605 homes.

⁷¹C.R.S.A. §§ 24-33.5-1203(u); 24-33.5-1228.

⁷²N.R.S. §§ 81-825 to 81-828.

represent the national need for firefighting aircraft. This concern is illustrated by the variety of federal and state agencies taking steps to compensate for the decline in large airtankers, which highlights the number of parties affected by firefighting aircraft decisions and reinforces the need for collaboration. Overall, better knowledge about aircraft effectiveness—and more complete input from all involved parties—could inform Forest Service and Interior decisions and help them ensure the adequacy of the nation's firefighting aircraft fleet. The challenges faced by the Forest Service in each phase of its large airtanker approach, which includes the potential acquisition of aircraft the federal government would own and operate for decades, underscore the need for a complete and collective understanding of the nation's firefighting aircraft needs.

Recommendations for Executive Action

To help the agencies enhance their abilities to identify their firefighting aircraft needs and better ensure they obtain aircraft that meet those needs, we recommend that the Secretaries of Agriculture and the Interior direct the Chief of the Forest Service and the Deputy Assistant Secretary for Public Safety, Resource Protection, and Emergency Services, respectively, to take the following three actions:

- Expand efforts to collect information on aircraft performance and effectiveness to include all types of firefighting aircraft in the federal fleet;
- Enhance collaboration between the agencies and with stakeholders in the fire aviation community to help ensure that agency efforts to identify the number and type of firefighting aircraft they need reflect the input of all stakeholders in the fire aviation community; and
- Subsequent to the completion of the first two recommendations, update the agencies' strategy documents for providing a national firefighting aircraft fleet to include analysis based on information on aircraft performance and effectiveness and to reflect input from stakeholders throughout the fire aviation community.

Agency Comments and Our Evaluation

We provided the Departments of Agriculture, Defense, and the Interior with a draft of this report for their review and comment.

The Forest Service (responding on behalf of the Department of Agriculture) and Interior generally agreed with our findings and recommendations, and their written comments are reproduced in appendixes IV and V respectively. The Forest Service and Interior also provided technical comments which we incorporated as appropriate. The Department of Defense did not provide comments.

While the Forest Service generally agreed with our findings and recommendations and stated that it is committed to improving its collaboration efforts, it also reiterated its interest in obtaining C-27Js to augment its aerial firefighting capabilities, citing the benefit of low initial investment for aircraft that could potentially function in multiple roles. As stated in our report, we acknowledge the Forest Service's incentive to obtain the C-27Js free of acquisition cost and their potential use in multiple roles. We also note, however, that the agency may face challenges regarding the retardant capacity and operating costs associated with the airtankers.

We are sending copies of this report to the Secretaries of Agriculture, Defense, and the Interior; the Chief of the Forest Service; the Directors of the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service; appropriate congressional committees; and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or fennella@gao.gov. Contact points for our Office of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix VI.



Anne-Marie Fennell
Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

This report examines (1) Forest Service and Department of the Interior efforts undertaken to identify the number and type of firefighting aircraft they need and (2) the Forest Service's approach to modernizing the large airtanker fleet and the challenges it faces in doing so.

To examine Forest Service and Interior efforts to identify their firefighting aircraft needs, we reviewed major agency studies and strategy documents and interviewed agency officials responsible for managing fire aviation programs. We focused on those efforts conducted since 1995, when the Forest Service and Interior jointly conducted the first major study of their large airtanker needs. We reviewed the purpose, methodology, and results of each of these studies and strategy documents. We also reviewed seven academic and government studies on aerial firefighting and conducted interviews with agency officials, as well as officials representing stakeholders in the fire aviation community, including military, state, and international firefighting organizations, and companies that own and operate firefighting aircraft, to identify key elements that are important for understanding firefighting aircraft needs.¹ (Information on the stakeholders included in our review is discussed in more detail later in this appendix.) Through these document reviews and interviews, and in consultation with internal GAO stakeholders including methodological specialists and staff knowledgeable about aviation contracting, we identified the following key elements: aircraft types, basing options, acquisition models, aircraft capabilities, suppression methods, and aircraft performance and effectiveness. We then reviewed the agency efforts to determine the extent to which each effort included analysis of these key elements.

We also interviewed agency officials about the extent of collaboration involved in agency efforts to identify the number and type of firefighting aircraft they need. In light of the information collected, we reviewed our prior work on interagency collaboration and key practices that can help enhance and sustain collaborative efforts, and compared the practices of the formal body for coordination among aerial firefighting agencies—the National Interagency Aviation Committee—with key collaboration practices to determine the extent to which the committee's practices were

¹We considered the methodologies of the academic and government studies that we reviewed and determined that the results of the studies were sufficiently reliable for the purpose of identifying key elements that are important for understanding firefighting aircraft needs.

consistent with key practices we previously identified. The key practices we evaluated were: defining and articulating a common outcome; establishing mutually reinforcing or joint strategies to achieve the outcome; identifying and addressing needs by leveraging resources; agreeing upon agency roles and responsibilities; establishing compatible policies, procedures, and other means to operate across agency boundaries; developing mechanisms to monitor, evaluate, and report the results of collaborative efforts; and reinforcing agency accountability for collaborative efforts through agency plans and reports.² GAO has also identified reinforcing individual accountability for collaborative efforts through agency performance management systems as a best practice for coordination, but we did not consider this practice in our assessment because performance management systems fell outside the scope of this review.

To examine the Forest Service's approach to modernizing the large airtanker fleet and the challenges it faces in doing so, we reviewed agency documents related to large airtanker acquisition, management, and operations and interviewed agency officials to identify the agency's approach to obtaining these aircraft. We reviewed agency planning and acquisition documents, such as the National Interagency Aviation Committee's 2009 *Interagency Aviation Strategy*, the Forest Service's 2012 *Large Airtanker Modernization Strategy*, and Forest Service airtanker contract solicitations, which lay out the Forest Service's approach to obtaining large airtankers in the short, medium, and long terms.

To collect information in support of both objectives, we interviewed members of the fire aviation stakeholder community, including officials involved in the management and operations of aerial firefighting from the Forest Service, Interior and its four land management bureaus, the Department of Defense, six state agencies that we selected based on input from federal agencies and the National Association of State Foresters, and the British Columbia Forest Service; representatives from eight of the nine vendors we identified that own, operate, and maintain large airtankers and that have responded to the most recent Forest Service contract solicitations;³ and two national trade organizations—one

²GAO-06-15. We identified these practices through reviewing relevant literature and interviewing experts in the area of collaboration.

³Representatives of the ninth vendor did not respond to our attempts to contact them.

that represents firefighting aircraft vendors and one that represents pilots—which we identified based on conversations with agency officials and vendor representatives. We also conducted site visits to the National Interagency Fire Center in Boise, Idaho; the facilities of the only two private vendors with current Forest Service “legacy” large airtanker contracts, located in Minden, Nevada, and Missoula, Montana; the manufacturing facility of a company that produces single-engine airtankers in Olney, Texas; and the headquarters of California’s fire aviation program—part of the California Department of Forestry and Fire Protection (CAL FIRE) in Sacramento—which manages more airtankers than the Forest Service. The results of our interviews and site visits are not generalizable.

We conducted this performance audit from August 2012 to August 2013 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: 2013 Forest Service and Interior Firefighting Aircraft Availability and Rates

The Forest Service and Interior contract for, and to a lesser extent own, a variety of aircraft used to help suppress wildland fires. Table 2 provides information, as reported by Forest Service and Interior contracting officials, on the federal firefighting aircraft fleet for the 2013 fire season, including aircraft type, number available, and cost rates.

Table 2: Type, Number, and Cost Rates for Federally-Contracted Firefighting Aircraft

Aircraft type	Exclusive-use contracts			Call-when-needed contracts		
	Number of aircraft	Daily availability rate	Flight hour rate	Number of aircraft	Daily availability rate	Flight hour rate
<i>Very large airtanker^{a,b,c}</i>	1	\$26,750	\$4,553-\$12,500	2	\$51,522-\$75,000	\$7,668-\$12,000
<i>Large airtanker^{a,c}</i>	15	\$10,700-\$34,000	\$4,400-\$9,996	0	-	-
<i>Single-engine airtanker^{d,e}</i>	28	\$1,700-\$4,076	\$1,500-\$3,988	46	\$2,225-\$4,150	\$2,305-\$4,242
<i>Water scooper^f</i>	2	\$9,859	\$6,363-\$7,918	1	\$11,549	\$7,158-\$8,637
<i>Large helicopter^g</i>	34	\$9,256-\$25,942	\$1,958-\$7,828	85	\$13,320-\$46,900	\$2,967-\$23,300
<i>Medium helicopter^g</i>	33	\$4,050-\$11,600	\$1,748-\$1,998	101	\$3,600-\$19,815	\$1,732-\$2,445
<i>Small helicopter</i>	78	\$950-\$5,775	\$330-\$2,350	^h	\$1,000-\$12,975	\$325-\$2,691
Forest Service	53	\$950-\$3,136	\$860-\$1,193	195	\$2,044-\$5,320	\$836-\$1,768
Interior	25	\$1,750-\$5,775	\$330-\$2,350	345	\$1,000-\$12,975	\$325-\$2,691
<i>Surveillance aircraftⁱ</i>	50	\$569-\$5,861	\$225-\$4,934	90	\$485-\$3,850	\$309-\$2,419
Forest Service	28	\$1,806-\$2,254	\$598	0	-	-
Interior	22	\$569-\$5,861	\$225-\$4,934	90	\$485-\$3,850	\$309-\$2,419
<i>Smokejumper aircraft</i>	14	\$3,315-\$5,597	\$950-\$2,020	1	\$4,600	\$1,300
Forest Service ^h	12	\$3,330-\$5,597	\$950-\$2,020	0	-	-
Interior	2	\$3,315-\$3,400	\$973-\$1,026	1	\$4,600	\$1,300

Sources: Forest Service and Interior contracting officials.

^aFlight hour rates do not include the cost of aircraft fuel.

^bThe DC-10 available on exclusive-use was awarded a contract under the "next generation" large airtanker solicitation and has a flight hour rate of \$4,553 for delivering 5,000 gallons and \$12,500 for delivering 11,600 gallons of retardant.

^cThe Forest Service contracts for these aircraft.

^dIncludes one exclusive-use and three call-when needed amphibious, water-scooping single-engine airtankers.

^eInterior contracts for these aircraft.

^fWe did not determine the total number of aircraft available because some vendors may have a single aircraft available on call-when-needed contracts with both the Forest Service and Interior.

Appendix II: 2013 Forest Service and Interior
Firefighting Aircraft Availability and Rates

⁹This category includes exclusive-use and call-when-needed lead planes as well as two Forest Service-owned infrared mapping aircraft; the availability costs of the infrared fire mapping aircraft are calculated on a monthly basis and range from \$23,064 to \$29,174.

¹⁰This category includes the seven smokejumper aircraft owned by the Forest Service; the availability costs of these aircraft are calculated on a monthly basis and range from \$11,972 to \$23,476.

Appendix III: Summary of Agency Efforts Since 1995 to Identify Number and Type of Firefighting Aircraft They Need

Since 1995, the Forest Service and Interior have conducted or contracted for nine major studies and strategy documents that identify firefighting aircraft needs. Table 3 provides information on major efforts conducted by, or on behalf of, the Forest Service and Interior to identify the number and type of firefighting aircraft they need.

Table 3: Purpose, Methodology, and Recommendations of Major Efforts to Identify Federal Firefighting Aircraft Needs, by Date

Author(s)	Purpose	Methodology used	Number and type of aircraft recommended
1995, <i>National Study of Airtankers to Support Initial Attack and Large Fire Suppression: Final Report Phase 1</i>			
Forest Service and Interior	Provide analytical support and develop models to identify the most effective and efficient utilization of airtankers and to optimize the currently available airtanker fleet and find the best base locations	Compared the cost of the 1995 large airtanker program—41 airtankers—with a series of alternatives, including no airtanker program, a smaller airtanker program, and moving airtankers to different base locations to determine the most efficient basing of large airtankers	41 large airtankers ^{a,b}
1996, <i>National Study of (Large) Airtankers to Support Initial Attack and Large Fire Suppression: Final Report Phase 2</i>			
Forest Service and Interior	Provide information on reasonable airtanker base locations and airtanker fleet possibilities to guide modernization of the airtanker program	Analyzed potential airtanker types and base locations using set of evaluation criteria—compatibility with airtanker bases, initial attack efficiency, large fire support, accuracy and performance, availability, viable vendors, and reality/professional judgment check—to determine the number and size of airtankers to station at each base	41 large airtankers ^{a,b}
1998, <i>National Study of Tactical Aerial Resource Management to Support Initial Attack and Large Fire Suppression: Final Committee Report</i>			
Forest Service and Interior	Determine the appropriate organization, locations, and aerial platforms to safely and cost effectively manage and direct aerial fire suppression resources	Compared available surveillance aircraft against a set of evaluation criteria, such as required technology, minimum speed, and minimum personnel capacity to determine the appropriate type of surveillance aircraft, and identified the number of surveillance aircraft needed based on the number of large airtankers recommended by the 1995 and 1996 studies	41 surveillance aircraft ^c
2005, <i>Wildland Fire Management Aerial Application Study</i>			
Fire Program Solutions, LLC	For initial attack, recommend most cost efficient large aircraft type and number by base and recommend performance attributes for airtankers and large helicopters to support cost efficient national program; for large fire support, determine airtanker and helicopter requirements	Analyzed the most efficient locations to place airtankers, by geographic area, and identified the scenario with the lowest total fire suppression, airtanker program, and potential fire damage costs; identified the most efficient combination of exclusive-use and call-when-needed large helicopters based on demand and cost	34-41 large airtankers ^b

Appendix III: Summary of Agency Efforts Since 1996 to Identify Number and Type of Firefighting Aircraft They Need

Author(s)	Purpose	Methodology used	Number and type of aircraft recommended
2008, Management Efficiency Assessment on Aviation Activities in the USDA Forest Service			
Management Analysis, Incorporated	Identify areas within the Forest Service aviation activities that can be improved through efficiencies in staffing, organization, communications, technology, and procedures	Compared the "as-is" conditions with desired "to-be" conditions for six Forest Service areas— aerial delivery of firefighters; aerial detection and command and control; aerial fire suppression—airtanker and large helicopter; aerial resources support; aviation contract management and quality assurance; and aviation program management—and conducted a cost/benefit analysis to identify recommendations for improving efficiency within each area	19 large airtankers ^b
2009, National Interagency Aviation Council Interagency Aviation Strategy			
Forest Service, Bureau of Indian Affairs, Bureau of Land Management, Interior, Fish and Wildlife Service, National Park Service, and National Association of State Foresters	Develop an aviation strategy for federal wildland fire agencies, including strategies for the organization, procurement, and management of aviation resources used in federal wildland firefighting	Identified the number of each type of aircraft needed in the national firefighting aircraft fleet by using numbers from preceding aviation program studies, simple demand analysis, and current program aircraft totals	32 large airtankers 3 water scoopers 35 single-engine airtankers 45 surveillance aircraft 19 smokejumper aircraft 34 large helicopters 47 medium helicopters 100 small helicopters
2012, Forest Service Large Airtanker Modernization Strategy			
Forest Service	Document the strategy for ensuring that the nation is equipped with a viable fleet of large airtankers	Analyzed options for large airtankers, based on the large airtanker requirements identified in the 1996 National Study of (Large) Airtankers to Support Initial Attack and Large Fire Suppression, Phase 2 and the 2009 National Interagency Aviation Council Interagency Aviation Strategy	18-28 large airtankers ^b
2012, Air Attack Against Wildfires: Understanding U.S. Forest Service Requirements for Large Aircraft			
Rand Corporation	Determined the composition of a fleet of large airtankers, water scooping aircraft, and large helicopters that would minimize the total costs of wildfires, including the cost of large fires and the cost of aircraft	Analyzed various compositions of a fleet of large airtankers, water scooping aircraft, and large helicopters to determine which composition would minimize the total costs of wildfires, including federal, state, and local suppression costs; post-fire rehabilitation costs; insured losses; fatalities; future suppression costs; and the cost of the prospective aircraft	1-9 large airtankers ^d 14-55 water scoopers 0-7 large helicopters

Appendix III: Summary of Agency Efforts Since 1995 to Identify Number and Type of Firefighting Aircraft They Need

Author(s)	Purpose	Methodology used	Number and type of aircraft recommended
2013, <i>Firefighting Aircraft Study</i>			
Avid LLC	Develop a performance measure that directly demonstrated cost-impact of large airtankers and heavy helicopters in firefighting	Used a supply and demand model to determine the annual number of airtanker orders that the Forest Service has been unable to fill with its contracted large airtankers	35 large airtankers are needed to fill 90 percent of requests for large airtankers ^a

Source: GAO analysis.

^aThis total of 41 includes 30 airtankers contracted by the Forest Service, 6 airtankers contracted by Interior, and 5 airtankers contracted by states.

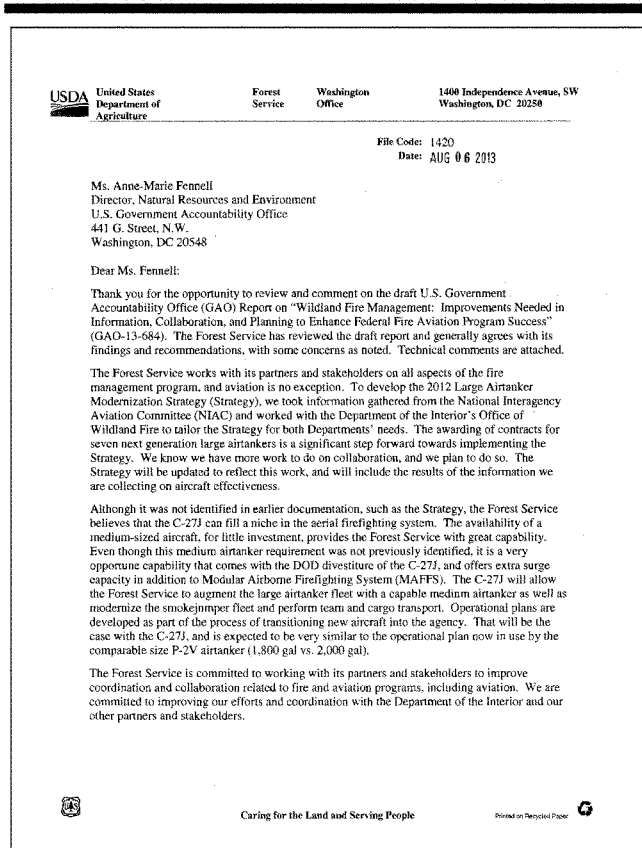
^bThis study recommended the appropriate number of large airtankers and did not recommend an appropriate number of other types of firefighting aircraft.

^cThis study recommended the appropriate number of aerial surveillance aircraft and did not recommend an appropriate number of other types of firefighting aircraft.

^dThis study focused on the Forest Service's large airtankers, water scoopers, and large helicopters, and did not recommend an appropriate number for other types of firefighting aircraft.

^eThis study focused on the Forest Service's large airtankers and large helicopters and did not recommend an appropriate number of large helicopters.

Appendix IV: Comments from the Department of Agriculture

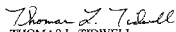


Appendix IV: Comments from the Department
of Agriculture

Ms. Anne-Marie Fennell, Director of Natural Resource Environment, U.S. Government
Accountability Office

2

Thank you again for the opportunity to review your draft report. If you have any questions,
please contact Thelma Strong, Chief Financial Officer, at 202-205-1321 or tstrong@fs.fed.us.
Sincerely,


THOMAS L. TIDWELL
Chief

Appendix V: Comments from the Department of the Interior



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240
AUG 8 2013

Ms. Anne-Marie Fennell
Director, Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Ms. Fennell:

Thank you for providing the Department of the Interior the opportunity to review and comment on the draft Government Accountability Office Report entitled *WILDLAND FIRE MANAGEMENT: Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success* (GAO-13-684).

The Department appreciates the work of the team that prepared the report and the amount of data collected. This report is an informative summation of the complex problems associated with Wildland Fire Management aviation. Interior concurs with the findings and recommendations included in the report. In collaboration with the Forest Service we will identify appropriate corrective actions.

Enclosed for consideration as the final report is prepared are Interior's general and technical comments. If you have any questions, or need additional information, contact Jim Douglas at 202-208-7754 or Mark Bathrick at 208-433-5001.

Sincerely,

A handwritten signature in black ink, appearing to read "Rhea Suh".

Rhea Suh
Assistant Secretary
Policy, Management and Budget

Enclosure

Appendix VI: GAO Contact and Staff Acknowledgments

GAO Contact

Anne-Marie Fennell, (202) 512-3841 or fennella@gao.gov

Staff Acknowledgments

In addition to the individual named above, Steve Gaty, Assistant Director; Kristin Hughes; Richard P. Johnson; and Matthew Tabbert made significant contributions to this report. Cheryl Arvidson, Steven Putansu, and Kiki Theodoropoulos provided technical assistance.

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 website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube. Subscribe to our RSS Feeds or E-mail Updates. Listen to our Podcasts. Visit GAO on the web at www.gao.gov.

**To Report Fraud,
Waste, and Abuse in
Federal Programs**

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

**Congressional
Relations**

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800, U.S. Government Accountability Office, 441 G Street NW, Room 7149, Washington, DC 20548



Please Print on Recycled Paper.



United States Government Accountability Office

Report to Congressional Requesters

September 2015

WILDLAND FIRE MANAGEMENT

Agencies Have Made
Several Key Changes
but Could Benefit from
More Information
about Effectiveness

GAO-15-772

GAO Highlights

Highlights of GAO-15-172, a report to congressional committees.

Why GAO Did This Study

Wildland fire plays an important ecological role in maintaining healthy ecosystems. Over the past century, however, various land management practices, including fire suppression, have disrupted the natural frequency of fires and have contributed to larger and more severe wildland fires. Wildland fires cost billions to fight each year, result in loss of life, and cause damage to homes and infrastructure. In fiscal years 2009 through 2014, the five federal wildland fire agencies obligated a total of \$2.3 billion to suppress wildland fires.

GAO was asked to review multiple aspects of federal wildland fire management across the five federal wildland fire management agencies. This report examines (1) key changes the federal wildland fire agencies have made in their approach to wildland fire management since 2009, (2) how the agencies assess the effectiveness of their wildland fire management programs, and (3) how the agencies determine the distribution of their wildland fire management resources. GAO reviewed laws, policies, and guidance related to wildland fire management, reviewed agency performance measures, reviewed obligation data for fiscal years 2009 through 2014, and interviewed officials from the five agencies, as well as Interior's Office of Wildland Fire.

What GAO Recommends

GAO recommends that the agencies develop specific criteria for selecting wildland fires for review and conducting the reviews, and revise agency policies accordingly. The agencies generally agreed with GAO's findings and recommendations.

New GAO-15-172. For more information, contact Kate M. Fennel at (202) 512-3821 or kfennel@gao.gov.

September 2015

WILDLAND FIRE MANAGEMENT

Agencies Have Made Several Key Changes but Could Benefit from More Information about Effectiveness

What GAO Found

Since 2009, the five federal agencies responsible for wildland fire management—the Forest Service within the Department of Agriculture and the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service in the Department of the Interior—have made several key changes in their approach to wildland fire management. One key change was the issuance of agency guidance in 2009 that provided managers with more flexibility in responding to wildland fires. This change allowed managers to consider different options for response given land management objectives and the risk posed by the fire. The agencies also worked with nonfederal partners to develop a strategy aimed at coordinating wildland fire management activities around common goals. The extent to which the agencies' steps have resulted in on-the-ground changes varied across agencies and regions, however, and officials identified factors, such as proximity to populated areas, that may limit their implementation of some changes.

The agencies assess the effectiveness of their wildland fire management programs in several ways, including through performance measures and reviews of specific wildland fires. The agencies are developing new performance measures, in part to help better assess the results of their current emphasis on risk-based management, according to agency officials. However, the agencies have not consistently followed agency policy regarding fire reviews, which calls for reviews of all fires resulting in federal suppression expenditures of \$10 million or more, nor have they used specific criteria for the reviews they have conducted. GAO has previously found that it is important for agencies to collect performance information to inform key management decisions and to identify problems and take corrective actions. Forest Service and Interior officials said focusing only on suppression costs does not allow them to identify the most useful fires for review, and they told GAO they are working to improve their criteria for selecting fires to review and conducting these reviews. Forest Service officials did not indicate a time frame for their efforts, and while they provided a draft update of their policy manual, it did not contain specific criteria. Interior officials told GAO they expect to develop criteria by the end of 2015, but did not provide information about how they planned to develop such criteria or the factors they would consider. By developing specific criteria for selecting fires to review and conducting reviews, and making commensurate changes to agency policies, the agencies may enhance their ability to help ensure that their fire reviews provide useful information about the effectiveness of their wildland fire activities.

The Forest Service and Interior determine the distribution of fire management resources for three primary wildland fire activities of suppression, preparedness, and fuel reduction in part on the basis of historical funding amounts. For suppression, the Forest Service and Interior manage suppression funding as needed for responding to wildland fires, estimating required resources using the average of the previous 10 years of suppression obligations. For preparedness and fuel reduction, the Forest Service and Interior distribute resources based primarily on historical amounts. Both are working to distribute resources in ways that better reflect current conditions, including developing new systems that they stated they plan to begin using in fiscal year 2016.

United States Government Accountability Office

Contents

Letter		1
	Background	5
	Agencies Have Made Several Key Changes in Their Approach to Wildland Fire Management Since 2009	16
	Agencies Assess Effectiveness of Their Programs in Several Ways, but Have Not Consistently Conducted Reviews That Could Improve Responses to Wildland Fires	27
	Agencies Distribute Resources in Part on the Basis of Historical Amounts, but Are Developing New Methods Intended to Better Reflect Current Conditions	34
	Conclusions	43
	Recommendations for Executive Action	44
	Agency Comments and Our Evaluation	44
Appendix I	Objectives, Scope, and Methodology	46
Appendix II	Forest Service and Interior Agency Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	50
Appendix III	Differences in Forest Service and Department of the Interior Salary Payments Using Preparedness and Suppression Funding	63
Appendix IV	Comments from the Department of Agriculture	64
Appendix V	Comments from the Department of the Interior	65
Appendix VI	GAO Contact and Staff Acknowledgments	68
Related GAO Products		69

Tables

Table 1: Forest Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	53
Table 2: Bureau of Indian Affairs Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	55
Table 3: Bureau of Land Management Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	57
Table 4: Fish and Wildlife Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	59
Table 5: National Park Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	61

Figures

Figure 1: Wildfire Hazard Potential for the Contiguous 48 States, 2014	7
Figure 2: Lands Managed by the Five Federal Land Management Agencies Responsible for Wildland Fire Management	9
Figure 3: Obligations for Suppression, Fuel Reduction, and Preparedness, Forest Service and Department of the Interior, Fiscal Years 2004 through 2014	13
Figure 4: Forest Service and Interior Agency Wildland Fire Preparedness Obligations, Fiscal Years 2004 through 2014	50
Figure 5: Forest Service and Interior Agency Fuel Reduction Obligations, Fiscal Years 2004 through 2014	51
Figure 6: Forest Service and Interior Agency Wildland Fire Suppression Obligations, Fiscal Years 2004 through 2014	52
Figure 7: Forest Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	54
Figure 8: Bureau of Indian Affairs Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	56

Figure 9: Bureau of Land Management Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	58
Figure 10: Fish and Wildlife Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	60
Figure 11: National Park Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014	62

Abbreviations

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
FLAME	Federal Land Assistance, Management, and Enhancement Act of 2009
FWS	Fish and Wildlife Service
HFPAS	Hazardous Fuels Prioritization and Allocation System
NFMAS	National Fire Management Analysis System
NPS	National Park Service
WFDSS	Wildland Fire Decision Support System
WUI	wildland-urban interface

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



U.S. GOVERNMENT ACCOUNTABILITY OFFICE

441 G St. N.W.
Washington, DC 20548

September 16, 2015

The Honorable Raúl Grijalva
Ranking Member
Committee on Natural Resources
House of Representatives

The Honorable Alan Lowenthal
Ranking Member
Subcommittee on Energy and Mineral Resources
Committee on Natural Resources
House of Representatives

The Honorable Peter DeFazio
House of Representatives

Wildland fire plays an important ecological role in maintaining healthy ecosystems, with many ecosystems being adapted to or dependent upon fire. However, over the past century, various land management practices, including fire suppression, have disrupted the normal frequency of fires in many forest and rangeland ecosystems across the United States, resulting in abnormally dense accumulations of vegetation. According to scientific reports, this altered landscape, combined with drought and other climate stressors, has contributed to larger and more severe wildland fires, and many scientists and researchers expect fires to become even larger and more severe in the future.¹ In addition, continued development occurring in and around wildlands, an area often called the wildland-urban interface (WUI), has placed more people, businesses, and other valuable infrastructure at risk from wildland fire. Wildland fires cost billions of dollars every year and have resulted in loss of life, both of residents as well as firefighters, and damage to homes and infrastructure. Wildland

¹See, for example, National Research Council, *Climate Change: Evidence, Impacts, and Choices. Answers to Common Questions about the Science of Climate Change* (Washington, D.C.: 2012) and U.S. Climate Change Science Program, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* (Washington, D.C.: May 2008). The National Resource Council report notes that the risk of wildland fire is expected to increase in many regions, such as the evergreen forests of the western United States, and may decrease in other areas, such as those dominated by shrubs and grasses.

fires have also destroyed or damaged important cultural resources and critical natural resources, such as watersheds that provide drinking water to communities.

Five federal agencies—the Forest Service within the Department of Agriculture and the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and National Park Service (NPS) within the Department of the Interior—are responsible for managing wildland fires on federal lands. State forestry agencies and other entities—including tribal, county, city, and rural fire departments—have primary responsibility for managing wildland fires on nonfederal lands and share responsibility for protecting homes and other private structures.

As noted in the *2014 Quadrennial Fire Review*, an interagency report prepared for the federal wildland fire agencies, balancing the need to suppress unwanted wildland fires to protect people and resources with the need to recognize fire's natural role on the landscape is a complex task.² In recent decades, increased wildland fire intensity has placed greater demands on federal wildland fire management programs and prompted new policies and efforts aimed at implementing more effective management strategies to manage wildland fire. These efforts take on greater importance in light of constrained budgets and the amount spent by federal agencies on wildland fire management; in fiscal years 2009 through 2014, for example, federal agencies reported obligating a total of \$8.3 billion to suppress wildland fires. According to several agency reports, given the current condition of the nation's landscapes and the future outlook for wildland fires, increasing demands on federal wildland fire management programs are likely to persist.³

²Booz Allen Hamilton, *2014 Quadrennial Fire Review* (Washington, D.C.: May 2015). The Quadrennial Fire Review, prepared on behalf of the Forest Service and Interior, is a strategic assessment process conducted by the fire management agencies every 4 years to evaluate current wildland fire management strategies and capabilities against estimates of the future fire environment. The first such review occurred in 2005 and the second in 2009.

³See, for example, Department of Agriculture and Department of the Interior, *The National Strategy: The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy* (Washington, D.C.: April 2014), and Booz Allen Hamilton, *2014 Quadrennial Fire Review* (Washington, D.C.: May 2015).

The five agencies' wildland fire management efforts have undergone multiple reviews, including by us and the Offices of Inspector General for Agriculture and Interior, to assess whether federal wildland fire activities and policies are appropriate and are being carried out in a cost-effective manner. We last conducted a comprehensive review of federal wildland fire management in 2009.⁴ The resulting report provided an overview of the agencies' efforts to address wildland fire issues, including the progress the agencies had made in managing wildland fire.

You asked us to review multiple aspects of federal wildland fire management across the five federal land management agencies responsible for wildland fire management. This report examines (1) key changes the federal wildland fire agencies have made in their approach to wildland fire management since 2009, (2) how the agencies assess the effectiveness of their wildland fire management programs, and (3) how the agencies determine the distribution of their wildland fire management resources.

To perform this work, we reviewed laws, policies, and guidance related to federal wildland fire management. We also interviewed headquarters officials from each of the five federal land management agencies responsible for wildland fire management (the Forest Service, BIA, BLM, FWS, and NPS), as well as Interior's Office of Wildland Fire.⁵ We also conducted interviews of officials from each of the 9 Forest Service regional offices and 11 of BLM's 12 state offices,⁶ as well as from selected BIA, FWS, and NPS regions.⁷ We focused these regional

⁴GAO, *Wildland Fire Management: Federal Agencies Have Taken Important Steps Forward, but Additional, Strategic Action Is Needed to Capitalize on Those Steps*, GAO-09-877 (Washington, D.C.: Sept. 9, 2009). For a list of GAO reports on topics related to federal wildland fire management, see the related products section at the end of this report.

⁵The Department of the Interior's Office of Wildland Fire organizes the activities of the four Interior agencies that manage and operate wildland fire programs. Specifically, it manages, oversees, and coordinates the department's wildland fire management programs, policies, budgets, information technology systems, and decision support tools.

⁶We did not interview officials from the BLM Eastern States Office because its wildland fire management program is minimal.

⁷The Forest Service, BIA, FWS, and NPS have regional offices, while BLM has state offices. For the purposes of this report, we refer to all of these as regional offices when we discuss the agencies collectively.

interviews primarily on the Forest Service and BLM because those agencies receive the greatest percentage of federal wildland fire funding. For BIA, FWS, and NPS, we selected the two regions from each agency that received the most funds—BIA's Northwest and Western Regions, FWS's Southwest and Southeast Regions, and NPS's Pacific West and Intermountain Regions. During these interviews, we asked about changes to the agencies' approach to wildland fire management, agency efforts to assess the effectiveness of their wildland fire management activities, and agency processes for determining the distribution of fire management resources.

To address our first objective, we reviewed agency documents, including policies, guidance, and reports such as the *Quadrennial Fire Review*, to identify changes the agencies have made to their approach to managing wildland fire since 2009, efforts the agencies have undertaken to address wildland fire management challenges, and any agency-identified improvements resulting from those changes. To further our understanding of these issues, we interviewed agency headquarters and regional officials about these changes. In particular, we asked about the extent to which changes to the agencies' wildland fire management approaches have occurred or are planned and how the regions implemented national direction and policy. We analyzed the responses provided to us during the interviews to identify prominent changes since 2009 and challenges associated with implementing them.

To address our second objective, we reviewed documents, such as agency strategic plans and budget justifications, and interviewed officials to identify key performance measures and other mechanisms the agencies use to determine the effectiveness of their wildland fire management programs, as well as any changes they are making in this area. We also reviewed legislative and agency direction related to fire reviews, including agency policies and the *Interagency Standards for Fire and Fire Aviation Operations*, and we reviewed reports resulting from fire reviews conducted by the agencies since 2009. We compared agency practices for conducting fire reviews to direction contained in relevant agency policy. To obtain additional insight into the use of performance information on the part of federal agencies, we also reviewed our previous reports related to agencies' use of performance information.

To address our third objective, we reviewed relevant agency budget documentation, including annual budget justifications, as well as information about the tools and systems the agencies use to distribute funds and resources, to identify the agencies' distribution processes. We

did not assess the design or the use of these tools or systems. We interviewed agency officials about their agencies' processes for budget formulation and resource distribution, including any differences among agencies or regional offices in how funds and resources are distributed, as well as the extent to which distribution decisions have changed in recent years at the headquarters and regional levels for each of the five agencies. We also obtained and analyzed Forest Service and Interior data on wildland fire management obligations for fiscal years 2004 through 2014, analyzing the data in both nominal (actual) and constant (adjusted for inflation) terms. We reviewed budget documents and obligation data provided by the agencies and interviewed agency officials knowledgeable about the data, and we found the data to be sufficiently reliable for the purposes of this report. Unless otherwise noted, dollar figures provided in this report represent obligations reported to us by the agencies and are presented in nominal dollars, unadjusted for inflation.⁸ Appendix I describes our objectives, scope, and methodology in more detail.

We conducted this performance audit from August 2014 to September 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Wildland fires are both natural and inevitable and play an important ecological role on the nation's landscapes. These fires have long shaped the composition of forests and grasslands, periodically reduced vegetation densities, and stimulated seedling regeneration and growth in some species. Wildland fires can be ignited by lightning or by humans either accidentally or intentionally. As we have described in previous reports, however, various land use and management practices over the past century—including fire suppression, grazing, and timber

⁸An obligation is a definite commitment that creates a legal liability of the government for the payment of goods and services ordered or received, or a legal duty on the part of the United States. Payment may be made immediately or in the future. An agency incurs an obligation, for example, when it places an order, signs a contract, awards a grant, or purchases a service.

harvesting—have reduced the normal frequency of fires in many forest and rangeland ecosystems.⁹ These practices contributed to abnormally dense, continuous accumulations of vegetation, which in turn can fuel uncharacteristically severe wildland fires in certain ecosystems.

According to scientific reports, several other factors have contributed to overall changes to ecosystems and the landscapes on which they depend, altering natural fire regimes and contributing to an increased frequency or intensity of wildland fire in some areas. For example, the introduction and spread of highly flammable invasive nonnative grasses, such as cheatgrass, along with the expanded range of certain flammable native species, such as western juniper, in the Great Basin region of the western United States—including portions of California, Idaho, Nevada, Oregon, and Utah—have increased the frequency and intensity of fire in the sagebrush steppe ecosystem.¹⁰ Changing climate conditions, including drier conditions in certain parts of the country, have increased the length and severity of wildfire seasons, according to many scientists and researchers.¹¹ For example, in the western United States, the average number of days in the fire season has increased from approximately 200 in 1980 to approximately 300 in 2013, according to the *2014 Quadrennial Fire Review*.¹² In Texas and Oklahoma this increase was even greater, with the average fire season increasing from fewer than 100 days to more than 300 during this time. According to the U.S. Global Change Research Program's 2014 National Climate Assessment, projected climate changes suggest that western forests in the United

⁹See, for example, GAO-09-877 and GAO, *Wildland Fire Management: Lack of Clear Goals or a Strategy Hinders Federal Agencies' Efforts to Contain the Costs of Fighting Fires*, GAO-07-655 (Washington, D.C.: June 1, 2007).

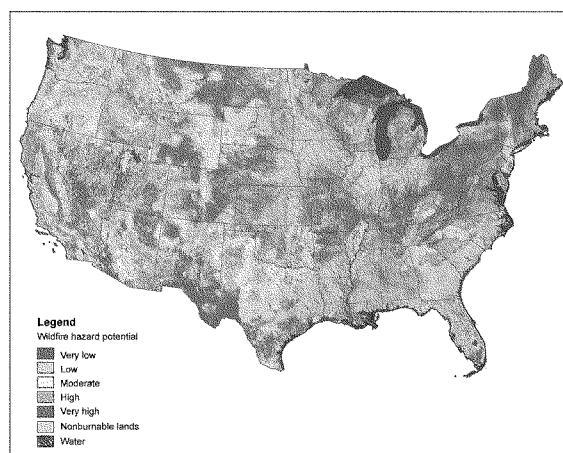
¹⁰The sagebrush steppe ecosystem is found in the western United States and western Canada. The sagebrush steppe name comes from the most dominant plant found in the ecosystem, the sagebrush, while steppe describes a largely treeless, dry, level grassland. According to BLM, the majority of BLM-managed lands are in the sagebrush steppe ecosystem.

¹¹See, for example, National Research Council, *Climate Change: Evidence, Impacts, and Choices. Answers to Common Questions about the Science of Climate Change* (Washington, D.C.: 2012) and U.S. Climate Change Science Program, *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* (Washington, D.C.: May 2008).

¹²Booz Allen Hamilton, *2014 Quadrennial Fire Review* (Washington, D.C.: May 2015). The states included in this statistic were Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

States will be increasingly affected by large and intense fires that occur more frequently.¹³ Figure 1 shows the wildfire hazard potential across the country as of 2014.

Figure 1: Wildfire Hazard Potential for the Contiguous 48 States, 2014



Source: Forest Service. | GAO-15-772

Note: According to the Forest Service, areas mapped with higher values of wildfire hazard potential represent fuels with a higher probability of extreme fire behavior under conducive weather conditions. The map does not represent a forecast or fire outlook for any particular season.

In addition, development in the wildland-urban interface (WUI) has continued to increase over the last several decades, increasing wildland fire's risk to life and property. According to the *2014 Quadrennial Fire Review*, 60 percent of new homes built in the United States since 1990 were built in the WUI, and the WUI includes 46 million single-family

¹³U.S. Global Change Research Program, *Climate Change Impacts in the United States: The Third National Climate Assessment* (Washington, D.C.: May 2014).

homes and an estimated population of more than 120 million. In addition to increased residential development, other types of infrastructure are located in the WUI, including power lines, campgrounds and other recreational facilities, communication towers, oil and gas wells, and roads. Some states, such as New Mexico and Wyoming, have experienced significant increases in oil and gas development over the past decade, adding to the infrastructure agencies may need to protect.

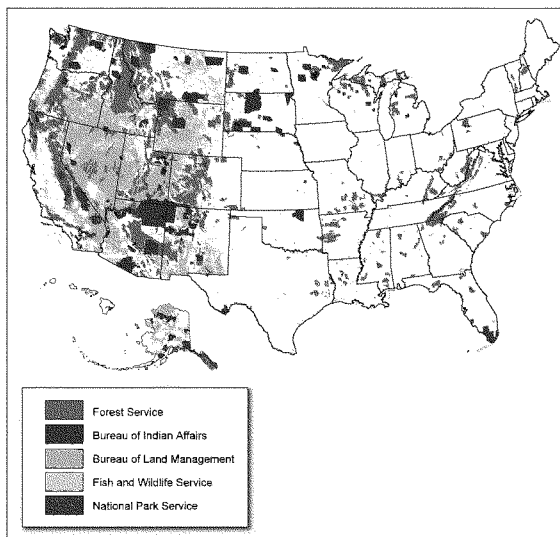
**Primary Federal Land
Management Agencies
with Wildland Fire
Management
Responsibilities**

Under the National Forest Management Act and the Federal Land Policy and Management Act of 1976, respectively, the Forest Service and BLM manage their lands for multiple uses such as protection of fish and wildlife habitat, forage for livestock, recreation, timber harvesting, and energy production.¹⁴ FWS and NPS manage federal lands under legislation that primarily calls for conservation; management for activities such as harvesting timber for commercial use is generally precluded.¹⁵ BIA is responsible for the administration and management of lands held in trust by the United States for Indian tribes, individuals, and Alaska Natives. These five agencies manage about 700 million surface acres of land in the United States, including national forests and grasslands, national wildlife refuges, national parks, and Indian reservations. The Forest Service and BLM manage the majority of these lands. The Forest Service manages about 190 million acres; BLM manages about 250 million acres; and BIA, FWS, and NPS manage 55, 89, and 80 million acres, respectively. Figure 2 shows the lands managed by each of these five agencies.

¹⁴These acts require the agencies to develop land management plans that provide for multiple uses. All land management actions must conform to the approved plan governing the land management unit—such as a national forest—where the action is to take place.

¹⁵The National Wildlife Refuge System Improvement Act of 1997 directs FWS to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The National Park Service Organic Act of 1916 created the National Park Service to promote and regulate the use of national parks, monuments, and reservations with the purpose of conserving the scenery, natural and historic objects, and wildlife therein and to leave them “unimpaired” for the enjoyment of future generations.

Figure 2: Lands Managed by the Five Federal Land Management Agencies Responsible for Wildland Fire Management



Sources: GAO analysis of U. S. Geological Survey's National Atlas website data; Map Resources (map). [GAO-15-772]

Severe wildland fires and the vegetation that fuels them may cross the administrative boundaries of the individual federal land management agencies or the boundaries between federal and nonfederal lands. State forestry agencies and other entities—including tribal, county, city, and rural fire departments—share responsibility for protecting homes and other private structures and have primary responsibility for managing wildland fires on nonfederal lands. Most of the increased development in

the WUI occurs on nonfederal lands, and approximately 70,000 communities nationwide are considered to be at high risk from wildland fire.¹⁶ Some of these communities have attempted to reduce risk of wildland fire through programs aimed at improving fire risk awareness and promoting steps to reduce their risk, such as the Firewise Communities program.¹⁷

**Key Components of
Wildland Fire
Management**

Wildland fire management consists of three primary components: preparedness, suppression, and fuel reduction.¹⁸

- **Preparedness.** To prepare for a wildland fire season, the five land management agencies acquire firefighting assets—including firefighters, fire engines, aircraft, and other equipment—and station them either at individual federal land management units or at centralized dispatch locations in advance of expected wildland fire activity. The primary purpose of acquiring these assets is to respond to fires before they become large—a response referred to as initial attack. The agencies fund the assets used for initial attack primarily from their wildland fire preparedness accounts.
- **Suppression.** When a fire starts, interagency policy calls for the agencies to consider land management objectives—identified in land and fire management plans developed by each land management unit—and the structures and resources at risk when determining whether or how to suppress the fire. A wide spectrum of strategies is available to choose from, and the land manager at the affected local

¹⁶Booz Allen Hamilton, *2014 Quadrennial Fire Review* (Washington, D.C.: May 2015).

¹⁷The Firewise Communities program is a nonregulatory program administered by the National Fire Protection Association and sponsored by the Forest Service, Interior, and state forestry organizations. It is designed to involve homeowners, community leaders, planners, developers, and others in efforts to protect people, property, and natural resources from the risk of wildland fire. Activities under the program include assisting individuals and residential communities with techniques to help protect homes and improve emergency preparedness in the event of wildland fire. Communities that take certain steps can become recognized as Firewise Communities sites. For more information on the program, see GAO, *Payments to Counties: More Clarity Could Help Ensure County Expenditures Are Consistent with Key Parts of the Secure Rural Schools Act*, GAO-12-775 (Washington, D.C.: July 16, 2012).

¹⁸Other fire program components include prevention; science, research, and development; site rehabilitation; and assistance to nonfederal entities.

unit is responsible for determining which strategy to use—from conducting all-out suppression efforts to monitoring fires within predetermined areas in order to provide natural resource benefits. When a fire is reported, the agencies are to follow a principle of closest available resource, meaning that, regardless of jurisdiction, the closest available firefighting equipment and personnel respond. In instances when fires escape initial attack and grow large, the agencies respond using an interagency system that mobilizes additional firefighting assets from federal, state, and local agencies, as well as private contractors, regardless of which agency or agencies have jurisdiction over the burning lands. The agencies use an incident management system under which specialized teams are mobilized to respond to wildland fires, with the size and composition of the team determined by the complexity of the fire. Federal agencies typically fund the costs of these activities from their wildland fire suppression accounts.

- **Fuel reduction.** Fuel reduction refers to agencies' efforts to reduce potentially hazardous vegetation that can fuel fires, such as brush and "ladder fuels" (i.e., small trees and other vegetation that can carry fire vertically to taller vegetation such as large trees), in an effort to reduce the potential for severe wildland fires, lessen the damage caused by fires, limit the spread of flammable invasive species, and restore and maintain healthy ecosystems.¹⁹ The agencies use multiple approaches for reducing this vegetation, including setting fires under controlled conditions (prescribed burns), mechanical thinning, herbicides, certain grazing methods, or combinations of these and other approaches. The agencies typically fund these activities from their fuel reduction accounts.

Risk is an inherent element of wildland fire management. Federal agencies acknowledge this risk, and agency policies emphasize the importance of managing their programs accordingly. For example, Forest Service guidance states that "the wildland fire management environment is complex and possesses inherent hazards that can—even with reasonable mitigation—result in harm." According to a 2013 Forest Service report on decision making for wildfires, risk management is to be

¹⁹In 2015, Interior changed the name of its fuel reduction account to "fuel management" and now generally refers to this activity as fuel management rather than fuel reduction. However, for the purposes of this report, we refer to these activities and accounts collectively as fuel reduction.

applied at all levels of wildfire decision making, from the individual firefighter on the ground facing changing environmental conditions to national leaders of the fire management agencies weighing limited budgets against increasingly active fire seasons.²⁰ For example, the report explains that, during individual wildland fires, risk can be defined as “a function of values, hazards, and probability.”²¹

**Funding for Federal
Wildland Fire
Management**

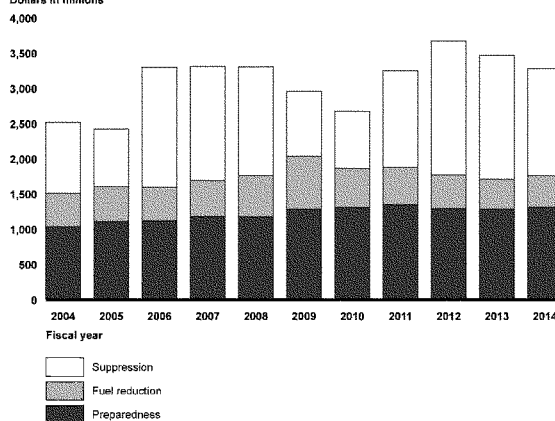
Congress, the Office of Management and Budget, federal agency officials, and others have raised questions about the growing cost of federal wildland fire management. According to a 2015 report by Forest Service researchers, for example, the amount the Forest Service spends on wildland fire management has increased from 17 percent of the agency's total funds in 1995 to 51 percent of funds in 2014.²² The report noted that this has come at the cost of other land management programs within the agency, such as vegetation and watershed management, some of which support activities intended to reduce future wildfire damage. From fiscal years 2004 through 2014, the Forest Service and Interior agencies obligated \$14.9 billion for suppression, \$13.4 billion for preparedness, and \$5.7 billion for fuel reduction. Figure 3 shows the agencies' total obligations for these three components of wildland fire management for fiscal years 2004 through 2014.

²⁰Department of Agriculture, Forest Service, Rocky Mountain Research Station, *Decision Making for Wildfires: A Guide for Applying a Risk Management Process at the Incident Level*, General Technical Report RMRS-GTR-298WWW (Ft. Collins, CO: June 2013).

²¹Values can include ecological, social, and economic values that could be lost or damaged due to fire, including people, property, infrastructure, natural and cultural resources, and air quality. Hazard is made up of the condition under which the fire burns, its ability to spread, and the intensity and severity it may present. For example, a fire that burns during extremely windy conditions may represent a greater hazard than a fire burning under less severe weather conditions. Probability is the likelihood of a fire becoming an active event and adversely affecting values, such as the likelihood that a fire will reach a particular point within a specified time period.

²²David E. Calkin, Matthew P. Thompson, and Mark A. Finney, “Negative Consequences of Positive Feedbacks in U.S. Wildfire Management,” *Forest Ecosystems*, vol. 2, no. 9 (2015).

Figure 3: Obligations for Suppression, Fuel Reduction, and Preparedness, Forest Service and Department of the Interior, Fiscal Years 2004 through 2014
Dollars in millions



Sources: GAO analysis of Forest Service and Interior data. | GAO-15-772

After receiving its annual appropriation, the Forest Service allocates preparedness and fuel reduction funds to its nine regional offices, and those offices in turn allocate funds to individual field units (national forests and grasslands). Interior's Office of Wildland Fire, upon receiving its annual appropriation, allocates preparedness and fuel reduction funds to BIA, BLM, FWS, and NPS. These agencies then allocate funds to their regional or state offices, which in turn allocate funds to individual field units (e.g. national parks or national wildlife refuges). The Forest Service and Interior agencies do not allocate suppression funding to their regions. These funds are managed at the national level.

Federal Wildland Fire Policy History

Federal wildland fire management policy has evolved over the past century in response to changing landscape conditions and greater recognition of fire's role in maintaining resilient and healthy ecosystems. According to wildland fire historians, in the late 1800s and early 1900s, the nation experienced a series of large and devastating fires that burned

millions of acres, including highly valued timber stands. In May 1908, federal legislation authorized the Forest Service to use any of its appropriations to fight fires.²³ During the following decades, the Forest Service and Interior agencies generally took the view that fires were damaging and should be suppressed quickly, with policies and practices evolving gradually. For example, in 1935, the Forest Service issued the “10 a.m. policy,” which stated that whenever possible, every fire should be contained by 10 a.m. on the day after it was reported. In more remote areas, suppression policies had minimal effect until fire towers, lookout systems, and roads in the 1930s facilitated fire detection and fire deployment.²⁴ The use of aircraft to drop fire retardants—that is, chemicals designed to slow fire growth—began in the 1950s, according to agency documents. Subsequent to the introduction of the 10 a.m. policy, some changes to agency policies lessened the emphasis on suppressing all fires, as some federal land managers took note of the unintended consequences of suppression and took steps to address those effects. In 1943, for example, the Chief of the Forest Service permitted national forests to use prescribed fire to reduce fuels on a case-by-case basis. In 1968, NPS revised its fire policy, shifting its approach from suppressing all fires to managing fire by using prescribed burning and allowing fires started by lightning to burn in an effort to accomplish approved management objectives.²⁵ In 1978, the Forest Service revised its policy to allow naturally ignited fires to burn in some cases, and formally abandoned the 10 a.m. policy.

Two particularly significant fire events—the Yellowstone Fires of 1988, in which approximately 1.3 million acres burned, and the South Canyon Fire of 1994, in which 14 firefighters lost their lives—led the agencies to fundamentally reassess their approach to wildland fire management and develop the Federal Wildland Fire Management Policy of 1995. Under the 1995 policy, the agencies continued to move away from their emphasis

²³Pub. L. No. 60-136, 35 Stat. 259 (1908). This legislation also established that 25 percent of the revenue received from each national forest—through activities such as timber sales—must be paid to the relevant state for use on roads and schools in the counties where the national forest is located. 35 Stat. 260.

²⁴Department of Agriculture, Forest Service, Pacific Northwest Research Station, *Ecological Foundations for Fire Management in North American Forest and Shrubland Ecosystems*, PNW-GTR-779 (March 2009).

²⁵Administrative Policies for Natural Areas of the National Park System.

on suppressing every wildland fire, seeking instead to (1) make communities and resources less susceptible to being damaged by wildland fire and (2) respond to fires so as to protect communities and important resources at risk while considering both the cost and long-term effects of that response. The policy was reaffirmed and updated in 2001, and guidance for its implementation was issued in 2003 and 2009.

In 2000, after one of the worst wildland fire seasons in 50 years, the President asked the Secretaries of Agriculture and the Interior to submit a report on managing the impact of wildland fires on communities and the environment. The report, along with congressional approval of increased appropriations for wildland fire management for fiscal year 2001, as well as other related activities, formed the basis of what is known as the National Fire Plan. The National Fire Plan emphasized the importance of reducing the buildup of hazardous vegetation that fuels severe fires, stating that unless hazardous fuels are reduced, the number of severe wildland fires and the costs associated with suppressing them would continue to increase. In 2003, Congress passed the Healthy Forests Restoration Act, with the stated purpose of, among other things, reducing wildland fire risk to communities, municipal water supplies, and other at-risk federal land through a collaborative process of planning, setting priorities for, and implementing fuel reduction projects.

Along with the development of policies governing their responses to fire, the agencies developed a basic operational framework within which they manage wildland fire incidents. For example, to respond to wildland fires affecting both federal and nonfederal jurisdictions, firefighting entities in the United States have, since the 1970s, used an interagency incident management system. This system provides an organizational structure that expands to meet a fire's complexity and demands, and allows entities to share firefighting personnel, aircraft, and equipment. Incident commanders who manage the response to each wildland fire may order firefighting assets through a three-tiered system of local, regional, and national dispatch centers. Federal, tribal, state, and local entities and private contractors supply the firefighting personnel, aircraft, equipment, and supplies which are dispatched through these centers. The agencies continue to use this framework as part of their approach to wildland fire management.

Agencies Have Made Several Key Changes in Their Approach to Wildland Fire Management Since 2009

Since 2009, the five federal agencies have made several changes in their approach to wildland fire management. The agencies have issued fire management guidance which, among other things, gave their managers greater flexibility in responding to wildland fires by providing for responses other than full suppression of fires. In collaboration with nonfederal partners such as tribal and state governments, they have also developed a strategy aimed at coordinating federal and nonfederal wildland fire management activities around common goals, such as managing landscapes for resilience to fire-related disturbances. In addition, Interior, and BLM in particular, have placed a greater emphasis on wildland fire management efforts in the sagebrush steppe ecosystem by issuing guidance and developing strategies aimed at improving the condition of this landscape. The agencies have also taken steps to change other aspects of wildland fire management, including changes related to improving fire management technology, line officer training, and firefighter safety. Agency officials told us the agencies are moving toward a more risk-based approach to wildland fire management. The extent to which the agencies' actions have resulted in on-the-ground changes varied across agencies and regions, however, and officials identified factors, such as proximity to populated areas, that may limit their implementation of some of these actions.

Agencies Issued Guidance That Provided Greater Flexibility in Responding to Wildland Fire

The agencies have increased their emphasis on using wildland fire to provide natural resource benefits rather than seeking to suppress all fires, in particular through issuing the *2009 Guidance for Implementation of Federal Wildland Fire Management Policy*. Compared with interagency guidance issued in 2003, the 2009 guidance provided greater flexibility to managers in responding to wildland fire to achieve natural resource benefits for forests and grasslands, such as reducing vegetation densities and stimulating regeneration and growth in some species. The 2003 guidance stated that only one "management objective" could be applied to a single wildland fire—meaning that wildland fires could either be managed to meet suppression objectives or managed for continued burning to provide natural resource benefits, but not both. The 2003 guidance also restricted a manager's ability to switch between full suppression and management for natural resource benefits, even when fire conditions changed. In contrast, under the 2009 interagency guidance, managers may manage individual fires for multiple objectives, and may change the management objectives on a fire as it spreads across the landscape. For example, managers may simultaneously attempt to suppress part of a fire that is threatening infrastructure or valuable resources while allowing other parts of the same fire to burn to

achieve desired natural resource benefits.²⁶ According to agency documents, the 2009 guidance was intended to reduce barriers to risk-informed decision making, allowing the response to be more commensurate with the risk posed by the fire, the resources to be protected, and the agencies' land management objectives.

However, agency officials varied in their opinions about the extent to which this guidance changed their management practices, with some telling us it marked a departure from their past practices, and others telling us it did not significantly change the way they managed wildland fire. Several headquarters and regional agency officials told us the guidance improved managers' ability to address natural resource needs when managing a fire, rather than simply suppressing all fires. For example, BIA officials told us that the flexibility provided through the guidance allowed managers on the San Carlos Apache Reservation in southeastern Arizona to use a variety of management strategies to manage the 2014 Skunk Fire. According to a BIA fire ecologist, managers were able to maximize firefighter safety while fostering desirable ecological benefits, including helping to restore the historical fire regime to the area.²⁷ In addition, Forest Service officials from several regions, including the Rocky Mountain and Intermountain Regions, told us they have used the full range of management options in the guidance more frequently over the last 5 years, and they credited the 2009 guidance for giving them the ability to manage fires and their associated risks. For example, during the 2011 Duckett Fire on the Pike-San Isabel National Forests in Colorado, managers attempted to contain part of the fire to protect a subdivision while allowing the portion of the fire uphill from the subdivision to burn into wilderness. Officials told us that, prior to the 2009 guidance, they would likely have responded to this fire by attempting full

²⁶The guidance states that the use of fire will be based on land or resource management plans and associated fire management plans prepared by individual units such as national parks. Land or resource management plans identify, among other things, fire's role in a particular area, and the objectives in the plans provide the basis for development of fire management objectives in designated areas. These fire-related objectives are contained in the units' fire management plans, which are intended to identify and integrate all wildland fire management and related activities within the context of approved land or resource management plans and assure that wildland fire management goals and components are coordinated.

²⁷A fire regime describes the role fire plays in an ecosystem, including typical fire frequency, scale, intensity, and duration.

suppression, which could have put firefighters at risk at the upper part of the fire because of the steep and rugged terrain.

In contrast, other officials told us the effect of the guidance was minimal because certain factors—including proximity to populated areas, size of the land management unit, and concerns about resources necessary to monitor fires—limit their ability to manage wildland fire incidents for anything other than suppression. For example, Forest Service officials from the Eastern Region told us that they try to use fire to provide natural resource benefits where possible, but they have fewer opportunities for doing so because of the smaller size of Forest Service land units in this region, which makes it more likely the fires will cross into nonfederal land, and their proximity to many areas of WUI. Similarly, Forest Service officials from the Pacific Southwest Region told us they are limited in using the added flexibility provided through the 2009 interagency guidance in Southern California, in part because the forests there are so close to major cities. However, in other more remote areas of California, these officials said they have managed wildland fires concurrently for one or more objectives, and objectives can change as the fire spreads across the landscape. Officials from BLM's Utah State Office also told us that their changed landscape is a limiting factor in responding to wildland fire. Specifically, cheatgrass, a nonnative, highly flammable grass, has replaced much of the native vegetation of the sagebrush steppe ecosystem that used to exist on the lands they manage in western Utah. As a result, introducing fire into this area could be detrimental rather than helpful because cheatgrass's flammability makes fires difficult to control.

Several officials also told us that managing wildland fires for objectives beyond full suppression, as provided for in the 2009 guidance, is highly dependent on circumstance. Officials told us that allowing fires to burn requires the agencies to devote assets to monitoring the fires to prevent them from escaping, which—especially for long-duration fires—can reduce the assets available to respond to other fires that may occur. For example, in 2012, in response to what it predicted to be an expensive and above-normal fire season, the Forest Service issued guidance to its regions limiting the use of any strategy other than full suppression (i.e., any strategy that involved allowing fires to burn for natural resource benefits) for the remainder of that year. The Forest Service noted that it was issuing this guidance because of concerns about committing the assets necessary to monitor long-duration fires that were allowed to burn in order to provide natural resource benefits. In 2015, during the Thunder Creek fire in North Cascades National Park, concerns about the resources needed to monitor the fire if it were allowed to burn to provide

natural resource benefits led NPS managers instead to order full suppression efforts to help ensure that the resources would be available for other fires. In a press release about the fire, NPS noted that experts anticipated a very high potential for wildfire in 2015, leading to agency concerns that significant fire activity throughout the west could leave few available firefighting resources later in the season.

**Agencies Made Changes
Intended to Formalize
Collaboration with
Nonfederal Partners**

Another change since 2009 was the completion in 2014 of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy), developed in collaboration with partners from multiple jurisdictions (i.e., tribal, state, and local governments, nongovernmental partners, and public stakeholders) and aimed at coordinating wildland fire management activities around common wildland fire management goals.²⁸ The agencies have a long history of collaboration with nonfederal partners in various aspects of wildland fire management, including mobilizing firefighting resources during wildland fire incidents and conducting fuel reduction projects across jurisdictions.²⁹ The Cohesive Strategy is intended to set broad, strategic, nationwide direction for such collaboration.

Specifically, the Cohesive Strategy provides a nationwide framework designed to more fully integrate fire management efforts across jurisdictions, manage risks, and protect firefighters, property, and landscapes by setting "broad, strategic, and national-level direction as a foundation for implementing actions and activities across the nation."³⁰ The vision of the Cohesive Strategy is "to safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural

²⁸The Federal Land Assistance, Management, and Enhancement (FLAME) Act of 2009 required the Forest Service and Interior to complete and submit to Congress a report that contains a "cohesive wildfire management strategy." Pub. L. No. 111-88 § 503, 123 Stat. 2971 (2009).

²⁹The Federal Wildland Fire Management Policy of 1995, updated in 2001, urged coordination, consistency, and agreement not only among the five federal land management agencies but also between these agencies and other federal agencies as well as tribal, state, and private stakeholders.

³⁰As part of the development of the Cohesive Strategy, each of three regions of the country—Northeast, Southeast, and Western—identified regional goals, objectives, and challenges to be incorporated into the national strategy, and the regions created implementation plans to help attain the goals.

resources; and as a nation, live with wildland fire.” The Cohesive Strategy identified three goals: (1) landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives; (2) human populations and infrastructure can withstand wildfire without loss of life or property; and (3) all jurisdictions participate in developing and implementing safe, effective, and efficient risk-based wildfire management decisions. According to a senior Forest Service official, the Wildland Fire Leadership Council is responsible for providing a national, intergovernmental platform for implementing the strategy.³¹ In September 2014, an interim National Cohesive Strategy Implementation Task Group completed an implementation framework that included potential roles, responsibilities, and membership for a “national strategic committee” that is intended to provide oversight and leadership on implementing the strategy.

Agency officials differed in the extent to which they viewed the Cohesive Strategy as having a significant effect on their wildland fire management activities. On the one hand, several headquarters and regional agency officials told us the Cohesive Strategy has improved wildland fire management. For example, Forest Service officials from the Southern Region told us the Cohesive Strategy has reinforced existing work that better enabled them to collaborate on new projects, which they told us is important because nearly 85 percent of the land base in the region is privately owned, and little could be achieved without collaboration. Forest Service officials cited one instance in which they signed a regional level agreement that will cover several state chapters of The Nature Conservancy to exchange resources for fuel reduction treatment and to promote public understanding of its benefits—an action they said was supported by the Cohesive Strategy.³² Similarly, Forest Service officials from the Intermountain Region told us about several efforts that have been implemented across their region that they attribute to the Cohesive

³¹The Wildland Fire Leadership Council consists of senior officials from the Departments of Agriculture, Interior, and Homeland Security, including the Agriculture Undersecretary and Deputy Undersecretary for Natural Resources and Environment, the Interior Assistant Secretary for Policy, Management, and Budget, the Administrator of the U.S. Fire Administration, and the heads of the five federal firefighting agencies. Other members include representatives of the Intertribal Timber Council, the National Association of State Foresters, and the Western Governors’ Association, along with a state forester and a local fire department chief.

³²According to its website, the Nature Conservancy is a nonprofit organization that works to protect ecologically important lands and waters.

Strategy. For example, in 2014, the Forest Service, the state of Utah, and other stakeholders collaborated on the implementation of Utah's Catastrophic Wildfire Reduction Strategy, which aims to identify where fuel treatment across the state would be most beneficial. In contrast, many officials told us they have collaborated with partners for years and did not find the additional direction provided through the Cohesive Strategy to be much different than how they already operated. For example, several regional BLM, FWS, and NPS officials told us they have long worked with nonfederal partners on issues related to wildland fire management and that the Cohesive Strategy did not change those relationships.

However, implementation of collaborative actions stemming from the Cohesive Strategy may be limited by such factors as differences in laws and policies among federal, tribal, state, and local agencies. For example, while the 2009 federal interagency guidance provided federal managers with additional flexibility in managing a single fire for multiple purposes, laws and regulations at the state and local levels typically require full suppression of all fires, according to the *2014 Quadrennial Fire Review*.³³ For example, according to California state law, state forest officials in California are "charged with the duty of preventing and extinguishing forest fires."³⁴

Increased Emphasis by Interior on the Sagebrush Steppe Ecosystem

Since 2009, Interior and BLM have placed a greater emphasis on wildland fire management, restoration, and protection related to the sagebrush steppe ecosystem—particularly with respect to habitat for the greater sage-grouse. Several changes, including urbanization and increased infrastructure built in support of various activities (e.g., roads and power lines associated with oil, gas, or renewable energy projects), have altered the sagebrush steppe ecosystem in the Great Basin region

³³The Forest Service is required to "in all ways that are practicable, aid in the enforcement of the laws of the States or Territories...for the prevention and extinguishment of forest fires[.]" 15 U.S.C. § 553. As noted in a 2006 report by the Department of Agriculture Inspector General, homeowner reliance on the federal government to provide suppression services in the WUI places a substantial financial burden on the Forest Service. Department of Agriculture, Office of Inspector General Western Region, *Audit Report: Forest Service Large Fire Suppression Costs*, Report No. 08601-44-SF (Washington, D.C.: November 2006).

³⁴Cal. Pub. Res. Code § 4113.

of the western United States.³⁵ In addition, the introduction and spread of highly flammable invasive nonnative grasses such as cheatgrass have altered this ecosystem by increasing the frequency and intensity of fire. As of July 2015, FWS was evaluating whether to list the greater sage-grouse, a species reliant on the sagebrush steppe ecosystem, as a threatened and endangered species under the Endangered Species Act.³⁶ FWS has noted the importance of fire and fuel management activities in reducing the threat to sage-grouse habitat.³⁷ Beginning in 2011, BLM issued guidance to its state offices emphasizing the importance of sage-grouse habitat in fire operations and the need for fuel reduction activities to address concerns about the habitat, more than half of which is located on BLM-managed lands. In 2014, the agency issued guidance reiterating this importance and stating that it would make changes in funding to allow field units to place greater focus on reducing fire's threats in sage-grouse habitat areas.

In January 2015, the Secretary of the Interior issued a Secretarial Order to enhance policies and strategies "for preventing and suppressing rangeland fire and for restoring sagebrush landscapes impacted by fire across the West."³⁸ The order established the Rangeland Fire Task Force and directed it to, among other things, complete a report on activities to be implemented ahead of the 2016 Western fire season. Under the order, the task force also was to address longer term actions to implement the policy and strategy set forth by the order. In a report issued in May 2015, *An Integrated Rangeland Fire Management Strategy*, the task force called for prepositioning firefighting assets where priority sage-grouse habitat exists, including moving assets from other parts of the country as available. The goal is to improve preparedness and suppression capability during initial stages of a wildfire to increase the chances of keeping fires small and reduce the loss of sage-grouse habitat.

³⁵The Great Basin region includes parts of California, Idaho, Nevada, Oregon, and Utah. More than 350 species of plants and animals are found in this region.

³⁶In 2011, FWS agreed to make a final listing decision concerning the greater sage-grouse by the end of fiscal year 2015.

³⁷75 Fed. Reg. 13910, 13982 (March 23, 2010).

³⁸*Secretarial Order 3336, Rangeland Fire Prevention, Management, and Restoration*, January 5, 2015.

The report also identified actions aimed at improving the targeting of fuel reduction activities, including identifying priority landscapes and fuel management priorities within those landscapes. These actions are to be completed by the end of September 2015 and continuously improved upon in subsequent years. According to BLM state officials, the increased emphasis on sage-grouse habitat will significantly change how they manage their fuel reduction programs. BLM officials from states that include sage-grouse habitat said they expect a large increase in fuel reduction treatment funding and increased project approvals. In contrast, BLM officials from states without this habitat told us they expect significant funding decreases, limiting their capacity to address other resource issues important for nonsagebrush ecosystems.

Agencies Made Additional Changes in Other Areas of Wildland Fire Management

Since 2009, the agencies also have taken steps to change other areas of wildland fire management, including technology for wildland fire planning and response, line-officer training, and firefighter safety.

Working to Improve Technology for Wildland Fire Planning and Response

Since 2009, the agencies have applied new technologies to improve wildland fire management planning and response. Prominent among them is the Wildland Fire Decision Support System (WFDSS), a Web-based decision-support tool that assists fire managers and analysts in making strategic and tactical decisions for fire incidents. WFDSS replaced older tools, some of which had been used for more than 30 years and were not meeting current fire management needs, according to the system's website.³⁹ According to this site, WFDSS has several advantages over the older systems, such as enabling spatial data layering,⁴⁰ increasing use of map displays, preloading information about field units' management objectives, and allowing for use in both single

³⁹https://wfdss.usgs.gov/wfdss/WFDSS_About.shtml, accessed August 10, 2015.

⁴⁰Geospatial data describe features or phenomena that can be referenced to specific locations relative to the earth's surface. For example, features such as buildings, rivers, and federal lands, and phenomena such as wildland fires, can all be tracked by their geographic locations in data layers. These data layers can then be linked (or "layered") to display the combined information as maps with different layers of information, which may facilitate analysis of how the data in the various layers interrelate. See GAO, *Geospatial Data: Progress Needed on Identifying Expenditures, Building and Utilizing a Data Infrastructure, and Reducing Duplicative Efforts*, GAO-15-193 (Washington, D.C.: Feb. 12, 2015).

and multiple fire situations. Officials from several agencies told us that using WFDSS improved their ability to manage fires by allowing information from fire management plans to be loaded into WFDSS and providing substantial real-time fire information on which to make decisions. For example, one Forest Service official told us that, at one point in a recent particularly active fire season in the Pacific Northwest Region, the system processed information on approximately 20 concurrent fires that managers could monitor in real time. As a result, they were able to make strategic and risk-informed decisions about the resource allocations needed for each fire, including decisions to let some fires burn to meet natural resource benefit objectives. According to Forest Service reviews of several fires that occurred in 2012, however, some managers said WFDSS did not provide effective decision support for firefighters because the system underestimated fire behavior or did not have current information.⁴¹

According to officials from several agencies, another example of updated wildland fire technology has been the replacement of traditional paper-based fire management plans with electronic geospatial-based plans. Federal wildland fire management policy directs each agency to develop a fire management plan for all areas they manage with burnable vegetation. A fire management plan, among other things, identifies fire management goals for different parts of a field unit. According to an interagency document describing geospatial-based plans, agency officials expect such plans to increase efficiency because the plans can more easily be updated to account for changes in the landscape resulting from fires, fuel reduction treatments, and other management activities. In addition, the electronic format is designed to allow plans to more easily be shared across multiple users, including personnel responding to wildland fires. Agency officials mentioned other technological improvements, such as the development of an "Enterprise Geospatial Portal" providing wildland fire data in geospatial form using a Web-based platform, although many officials also told us that additional improvements are needed in wildland fire technology overall.

In addition to specific technologies, in 2012 the Forest Service and Interior issued a report titled "Wildland Fire Information and Technology:

⁴¹Wildland Fire Lessons Learned Center, *Lessons From Recent Large Fire Reviews Briefing Paper* (August 7, 2013).

Increasing Line-Officer
Training

Strategy, Governance, and Investments," representing the agencies' efforts to develop a common wildland fire information and technology vision and strategy. The agencies signed a Memorandum of Understanding later that same year intended to establish a common management approach for information and technology services. Nevertheless, the *2014 Quadrennial Fire Review* concluded that the wildland fire management community does not have an agenda for innovation and technology adoption or a list of priorities, stating that the wildland fire community "sometimes struggles to define common technology priorities and implement integrated, enterprise-level solutions" and noting that there are more than 400 information technology systems in use by the wildland fire community.⁴² The report provides recommendations on actions the agencies could consider for improvement; however, because it was issued in May 2015, it is too early to determine what, if any, actions the agencies have taken. In commenting on a draft of this report, Interior stated that the agencies are completing an investment strategy for wildland fire applications and supporting infrastructure, but did not provide an expected date for its completion.

Officials from several agencies told us that, since 2009, the agencies have increased training efforts, particularly those aimed at improving line officers' knowledge about, and response to, wildland fires. Line officers are land unit managers such as national forest supervisors, BLM district managers, and national park superintendents. During a wildland fire, staff from "incident management teams" with specific wildland firefighting and management training manage the response, and line officers associated with the land unit where the fire is occurring must approve major decisions that incident management teams make during the response.⁴³ Officials at BLM's Oregon/Washington State Office, for example, told us they provide line officers with day-long simulation exercises, as well as shadowing opportunities that give line officers experience on actual wildland fires. Beginning in 2007, the Forest Service initiated a Line Officer Certification Program and began a coaching and mentoring

⁴²We did not examine the agencies' information technology systems as part of this review.

⁴³For large and complex fires, an incident management team comprising an incident commander and a cadre of personnel to handle command, planning, logistics, operations, and finance functions manages suppression operations. The incident management team orders firefighting assets—including personnel, aircraft, equipment, and supplies—through a three-tiered system of local, regional, and national dispatch centers.

Emphasizing the Primacy of
Firefighter Safety

program to provide on-the-ground experience for preparing line officers to act as agency administrators during wildland fires or other critical incidents. This program is aimed at providing officials that do not have wildland fire experience the opportunity to work under the advisement of a coach with wildland fire experience. According to Forest Service documents, this program has evolved substantially, in part to address the increased demand for skills necessary to manage increasingly complex wildland fires. In May 2015, the Forest Service issued guidance for the program and called for each Forest Service regional office to administer it within the regions.

Officials told us that, since 2009, the agencies have, in some cases, changed firefighting tactics to better protect firefighters, including making greater use of natural barriers to contain fire instead of attacking fires directly. The agencies have also issued additional guidance aimed at emphasizing the primacy of firefighter safety. In 2010, the agencies developed and issued the "Dutch Creek Protocol" (named after a wildland fire where a firefighter died), which provided a standard set of protocols for wildland firefighting teams to follow during an emergency medical response or when removing and transporting personnel from a location on a fire. Both the Forest Service and Interior have also issued agency direction stating that firefighter safety should be the priority of every fire manager.⁴⁴

⁴⁴See, for example, Departments of Agriculture and the Interior, *2015 Direction to Wildland Fire Leadership* (Washington, D.C.: June 4, 2015), and Forest Service, *Chief's Letter of Intent – 2015 Fire Management* (Washington, D.C.: Jan. 28, 2015).

Agencies Assess Effectiveness of Their Programs in Several Ways, but Have Not Consistently Conducted Reviews That Could Improve Responses to Wildland Fires

The agencies assess the effectiveness of their wildland fire management programs in several ways, including through performance measures, efforts to assess specific activities, and reviews of specific wildland fire incidents. Both the Forest Service and Interior are developing new performance measures and evaluations, in part to help better assess the results of their current emphasis on risk-based management, according to agency officials. In addition, the agencies have undertaken multiple efforts, such as studies, to assess the effectiveness of activities including fuel reduction treatments and aerial firefighting. The agencies also conduct reviews of their responses to wildland fires. However, they have not consistently followed agency policy in doing so or used specific criteria for selecting the fires they have reviewed, limiting their ability to help ensure that their fire reviews provide useful information and meaningful results.

Agencies Use Various Performance Measures to Assess Wildland Fire Management

Both the Forest Service and Interior use various performance measures, such as the number of WUI acres treated to reduce fuels and the percentage of wildland fires contained during initial attack, to assess their wildland fire management effectiveness. These measures are reported in, among other things, the agencies' annual congressional budget justifications. Officials from both the Forest Service and Interior told us their performance measures need improvement to more appropriately reflect their approach to wildland fire management and, in June 2015, officials from both agencies told us that they were working to improve them. For example, several performance measures for both agencies use a "stratified cost index" to help analyze suppression costs on wildfires. The index is based on a model that compares the suppression costs of fires that have similar characteristics, such as fire size, fuel types, and proximity to communities, and identifies the percentage of fires with suppression costs that exceeded the index. We found in a June 2007 report, however, that the index was not entirely reliable and that using the index as the basis for comparison may not allow the agencies to accurately identify fires where more, or more-expensive, resources than needed were used.⁴⁵ The agencies continue to use the index, but have

⁴⁵We did not make a recommendation regarding this issue, noting that it would take several years, at the earliest, before the agencies could collect enough data for the model to be useful. See GAO-07-655.

acknowledged its shortcomings.⁴⁶ The Forest Service reported in its fiscal year 2016 budget justification to Congress that improvements were forthcoming. In April 2015, Forest Service officials told us they have incorporated detailed geospatial information into the model on which the index is based to help yield more accurate predictions of suppression expenditures and have submitted the model for peer review. Once that is complete, the agencies plan to begin to implement the updated model, but officials did not provide a time frame for doing so.

Both agencies have also made efforts to improve their performance measures to better reflect their emphasis on a risk-based approach to wildland fire management. In fiscal year 2014, Interior began using a new performance measure intended to better reflect a variety of strategies in addition to full suppression: "Percent of wildfires on DOI-managed landscapes where the initial strategy (ies) fully succeeded during the initial response phase."⁴⁷ The same year, the Forest Service began developing a performance measure intended to reflect that, in some cases, allowing naturally-ignited fires to burn can provide natural resource benefits at a lower cost and lower risk to personnel than fully suppressing the fire as quickly as possible: "Percent of acres burned by natural ignition with resource benefits." Forest Service officials told us they are working with field units to evaluate whether this measure will effectively assess their efforts to implement a risk-based approach to fire management and that they will adjust it as needed. The officials told us they plan to finalize the measure and use it in 2017.

Also, in fiscal year 2014, the Forest Service began developing a performance measure that would assess the risk that wildland fire presents to highly valued resources such as communities and watersheds. This measure is known as the "National Forest System wildfire risk index." According to the agency's fiscal year 2016 budget justification, it would create an index of relative fire risk based on the

⁴⁶Specifically, the index does not account for two of the main factors that influence suppression costs. These factors are long-term ecological conditions and changing climatic conditions, both of which may have substantial effects on fire management strategies. See Department of Agriculture, Forest Service, *Fiscal Year 2016 Budget Justification* (Washington, D.C.: February 2015).

⁴⁷Interior officials told us this measure is based on information supplied by the field units responsible for the initial fire response, and that these units are responsible for determining whether the initial strategies succeeded.

likelihood of a large fire affecting these highly valued resources. It may also incorporate factors measuring the relative importance of these resources and the expected effects that might occur from fire. The Forest Service plans to establish a national baseline measure for this index in 2015 and then periodically remeasure it, likely every 2 years, to determine if overall risk has been reduced, according to Forest Service officials. Changes that could affect the index include those resulting from fuel reduction treatments, wildland fire, forest management activities, vegetative growth, and increased WUI development, among others, according to the agency's 2016 budget justification. As with the performance measure described above, agency officials told us they will evaluate whether the measure meets their needs before adopting it; if it meets their needs, they plan to finalize the measure and use it in 2017.

Agencies Have Undertaken Multiple Efforts to Assess Effectiveness of Specific Activities

The agencies have also undertaken multiple efforts to assess the effectiveness of particular activities, such as fuel reduction and aerial firefighting. Regarding fuel reduction activities, we found in September 2007 and September 2009 that demonstrating the effectiveness of fuel reduction treatments is inherently complex and that the agencies did not have sufficient information to evaluate fuel treatment effectiveness, such as the extent to which treatments changed fire behavior.⁴⁸ Without such information, we concluded that the agencies could not ensure that fuel reduction funds were directed to the areas where they can best minimize risk to communities and natural and cultural resources. Accordingly, we recommended that the agencies take actions to develop additional information on fuel treatment effectiveness.⁴⁹ While the agencies took steps to address this recommendation, they are continuing efforts to improve their understanding of fuel treatment effectiveness. For example, the Forest Service and Interior agencies use a system called Fuel Treatment Effectiveness Monitoring to document and assess fuel

⁴⁸GAO, *Wildland Fire Management: Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuel Reduction Funds and Selecting Projects*, GAO-07-1166 (Washington, D.C.: Sept. 28, 2007) and GAO-09-877.

⁴⁹See GAO-07-1166.

reduction treatment effectiveness.⁵⁰ The Forest Service began requiring such assessments in 2011 and Interior requested such assessments be completed starting in 2012.⁵¹ Under this approach, the agencies are to complete a monitoring report whenever a wildfire interacts with a fuel treatment and enter the information into the system. Officials told us that additional efforts are under way to help understand other aspects of fuel treatment effectiveness. For example, in February 2015, the Joint Fire Science Program completed its strategy to implement the 2014 Fuel Treatment Science Plan.⁵² It includes as one of its goals the "development of measures/metrics of effectiveness that incorporate ecological, social, resilience, and resource management objectives at the regional and national level."

The Forest Service and Interior are also implementing an effort known as the Aerial Firefighting Use and Effectiveness Study, begun in 2012 to address concerns about limited performance information regarding the use of firefighting aircraft. As part of this effort, the agencies are collecting information on how aerial retardant and suppressant delivery affects fire behavior and plan to use this and other collected information to track the performance of specific aircraft types, according to the study website.⁵³ This will help the agencies identify ways to improve their current fleet of aircraft and inform future aerial firefighting operations and aviation

⁵⁰Fuel Treatment Effectiveness Monitoring is a program to evaluate the effectiveness of prescribed fire and mechanical treatments designed to reduce the risk of wildfire. Forest Service and Interior agencies conduct assessments in instances where a wildfire either starts within or burns into a fuel treatment area, to evaluate the resulting impacts on fire behavior and fire suppression actions.

⁵¹The Interior agencies each issued their own guidance related to Fuel Treatment Effectiveness Monitoring. NPS issued guidance in 2012, BIA in 2013, BLM in 2014, and FWS in 2015.

⁵²The Joint Fire Science Program is an interagency program that funds scientific research on wildland fires and distributes results to help policymakers, fire managers, and practitioners make sound decisions. The program is jointly funded by the Departments of Agriculture and the Interior and is governed by a 10-member board with 5 members from the Forest Service and 1 member each from BIA, BLM, FWS, NPS, and the U.S. Geological Survey. According to the program website, it has funded more than 170 studies examining the effectiveness of fuel reduction treatments in different locations since 1998.

⁵³<http://www.fs.fed.us/fire/aviation/afue/index.html>, accessed July 31, 2015.

strategic planning, according to the website.⁵⁴ Agency officials told us the study is not a one-time activity, but is an ongoing effort to continually provide information to help improve their use of firefighting resources.

Forest Service and Interior Agencies Have Not Consistently Conducted Reviews of Wildland Fire Incidents to Assess their Effectiveness

The Forest Service and the Interior agencies have conducted reviews to assess their effectiveness in responding to wildland fires but have not consistently followed agency policy in doing so and did not always use specific criteria for selecting the fires they have reviewed. Officials from both the Forest Service and Interior told us that current agency policy regarding fire reviews overly emphasizes the cost of wildland fire suppression rather than the effectiveness of their response to fire. However, the agencies have neither updated their policies to better reflect their emphasis on effectiveness nor established specific criteria for selecting fires for review and conducting the reviews. By developing such criteria, the agencies may enhance their ability to obtain useful, comparable information about their effectiveness in responding to wildland fires, which, in turn, may help them identify needed improvements in their wildland fire approach.

Congressional reports and agency policy have generally called for the agencies to review their responses to wildland fires involving federal expenditures of \$10 million or more. For fiscal years 2003 through 2010, congressional committee reports directed the Forest Service and Interior to conduct reviews of large fire incidents, generally for the purpose of understanding how to better contain suppression costs; beginning in fiscal year 2006, these reports included a cost threshold, specifying that such reviews be conducted for fires involving federal expenditures of \$10 million or more. The agencies, in turn, have each developed their own policies that generally direct them to review each fire that exceeds the \$10 million threshold.⁵⁵

⁵⁴In 2013, we recommended that the Forest Service and Interior expand efforts to collect information on aircraft performance and effectiveness to include all types of firefighting aircraft in the federal fleet, among other recommendations. See GAO, *Wildland Fire Management: Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success*, GAO-13-684 (Washington, D.C.: Aug. 20, 2013).

⁵⁵In some cases, those policies note that fire reviews may be conducted for other purposes, such as where the fire raised significant political, social, natural resource, or policy concerns.

The agencies, however, have not consistently conducted reviews of fire incidents meeting the \$10 million threshold, in part because, according to officials, current agency policy that includes the \$10 million threshold does not reflect the agencies' focus on assessing the effectiveness of their response to fire. However, the agencies have not developed specific criteria for selecting fire incidents for review. Forest Service officials told us that, rather than selecting all fires with federal expenditures of \$10 million or more, they changed their approach to selecting fires to review. These officials told us that focusing exclusively on suppression costs when selecting fires limits the agency in choosing those fires where it can obtain important information and best assess management actions and ensure they are appropriate, risk-based, and effective. Forest Service officials told us the agency judgmentally selects incidents to review based on a range of broad criteria, such as complexity and national significance, taking into account political, social, natural resource, or policy concerns. Using these broad selection criteria, the Forest Service reviewed 5 wildland fires that occurred in 2012 and 10 that occurred in 2013. However, with these broad criteria it is not clear why the Forest Service selected those particular fires and not others. For example, the 2013 Rim Fire, which cost over \$100 million to suppress—by far the costliest fire to suppress that year—and burned over 250,000 acres of land,⁵⁶ was not among the 2013 fires selected for review. Moreover, the reviews completed for each of those years did not use consistent or specific criteria for conducting the reviews. As of July 2015, the agency had not selected the fires it will review from the 2014 wildland fire season and, when asked, agency officials did not indicate a time frame for doing so.

Forest Service officials told us they believe it is appropriate to judgmentally select fires to provide them flexibility in identifying which fires to review and which elements of the fire response to analyze. Nevertheless, Forest Service officials also acknowledged the need to develop more specific criteria for selecting fires to review and conducting the reviews and, in July 2015, told us they are working to update their criteria for doing so. They provided us a draft update of the Forest Service policy manual, but this draft did not contain specific criteria for selecting fires for review or conducting the reviews. Moreover, officials did not provide a time frame for completing their update.

⁵⁶The Rim Fire burned about 154,000 acres of Forest Service land, about 79,000 acres of NPS land, and about 23,000 acres of private land.

Within Interior, BLM officials told us BLM completed its last fire review based on significant cost (i.e., federal expenditures of \$10 million or more) in 2013. These officials told us that BLM, similar to the Forest Service, plans to shift the emphasis of its fire reviews to evaluate management actions rather than focusing on cost, and that officials are working to determine criteria for selecting fires for review.⁵⁷ Interior headquarters officials told us that FWS and NPS have continued to follow the direction provided through their policies regarding reviews of fires that met the \$10 million threshold. Interior headquarters officials, however, acknowledged the need to improve Interior's approach to selecting fires for review to focus more on information about decision making rather than fire costs. In July 2015, the officials told us they plan to develop criteria other than cost for use by all Interior agencies in selecting fires to review, and that they plan to develop standard criteria for implementing the reviews. They stated that they expect this department-wide effort to be completed by the end of calendar year 2015 but did not provide information about how they planned to develop such criteria or the factors they would consider.

Agency reports have likewise cited the need to improve both the processes for selecting fires for review and the implementation of the reviews. A 2010 report, for example, noted the importance of improving the selection of fires to review and stated that the agencies would benefit from a more productive review strategy.⁵⁸ The report said the agencies' existing approach to conducting reviews tended to produce isolated efforts and unrelated recommendations rather than establishing a consistent foundation for continuous improvement. A 2013 report assessing the usefulness of the Forest Service's five reviews of 2012 fires noted shortcomings in consistency across the reviews, including unclear criteria for selecting fires and conducting reviews, as well as limitations in the specificity of the resulting reports and recommendations.⁵⁹ As noted,

⁵⁷In June 2015, BLM issued guidance for reviewing fires occurring in sage-grouse habitat. The guidance calls for reviews of fires occurring during the 2015 wildland fire season on BLM-administered lands containing at least 10,000 acres of specifically designated sage-grouse habitat.

⁵⁸Department of Agriculture Independent Large Fire Cost Review Panel and Guidance Group, Inc., *Large Fire Cost Review for Fiscal Year 2009* (August 2010).

⁵⁹Wildland Fire Lessons Learned Center, *Lessons From Recent Large Fire Reviews Briefing Paper* (August 7, 2013). There was no similar analysis performed of the Forest Service's 10 reviews of fires occurring in 2013.

both agencies have acknowledged the need to improve their criteria for selecting fires to review and conducting the reviews. By developing specific criteria in agency policies for selecting fires for review and conducting the reviews, the agencies may enhance their ability to help ensure that their fire reviews provide useful information and meaningful results. This is consistent with our previous body of work on performance management, which has shown that it is important for agencies to collect performance information to inform key management decisions, such as how to identify problems and take corrective actions and how to identify and share effective approaches.⁶⁰ By collecting such performance information, the agencies may be better positioned to identify needed improvements in their wildland fire approach and thereby use their limited resources more effectively.

Agencies Distribute Resources in Part on the Basis of Historical Amounts, but Are Developing New Methods Intended to Better Reflect Current Conditions

The Forest Service and Interior determine the distribution of fire management resources in part on the basis of historical amounts but are developing new methods intended to better reflect current conditions. For suppression, the Forest Service and Interior manage funding as needed for units to respond to individual wildland fires. For preparedness, the Forest Service and Interior distribute resources based, in part on historical funding levels generated by an obsolete system.⁶¹ The agencies are working to replace the system and develop new tools to help them distribute resources to reflect current landscape conditions, values at risk,⁶² and the probability of wildland fire. For fuel reduction, until recently, the Forest Service and Interior both distributed funds using the same system. In 2014, the Forest Service began using a new system to help it distribute fuel reduction funding in ways that better reflect current

⁶⁰See GAO, *Managing for Results: Enhancing Agency Use of Performance Information for Management Decision Making*, GAO-05-927 (Washington, D.C.: Sept. 9, 2005); GAO, *Nanotechnology: Improved Performance Information Needed for Environmental, Health, and Safety Research*, GAO-12-427 (Washington, D.C.: May 21, 2012), and GAO-13-684.

⁶¹As noted, the Forest Service allocates preparedness and fuel reduction funding directly to its nine regions, while Interior allocates funds to its four agencies, which in turn allocate to their respective regional offices. For both the Forest Service and the Interior agencies, once regional offices receive funding, they in turn allocate funds to individual units such as national forests or national parks.

⁶²As noted, values can include ecological, social, and economic values that could be lost or damaged due to fire, including people, property, infrastructure, natural and cultural resources, and air quality.

conditions. Interior is working to develop a system that likewise reflects current conditions.

**Agencies Fund
Suppression as Needed
for Responding to
Wildland Fires**

The agencies manage funding for suppression at the national level as needed for field units to respond to individual wildland fires. The overall amount of suppression funding the agencies obligate is determined by the complexity and number of wildland fire responses over the course of the fiscal year and can vary considerably from year to year. For example, federal agencies obligated approximately \$1.7 billion for suppression in fiscal year 2006, \$809 million in fiscal year 2010, and \$1.9 billion in fiscal year 2012.⁶³ (See app. II for more detailed information about suppression obligations by the Forest Service and the Interior agencies for fiscal years 2004 through 2014.)

Each year, the agencies estimate the expected level of funding for suppression activities using the average of the previous 10 years of suppression obligations.⁶⁴ The estimated amount, however, has often been less than the agencies' actual suppression obligations, particularly for the Forest Service. In all but 2 years since 2000, Forest Service suppression obligations have exceeded the 10-year average that forms the basis of the agency's annual appropriation. To pay for wildfire suppression activities when obligations are greater than the amount appropriated for suppression, the Forest Service and Interior may transfer funds from other programs within their respective agencies as permitted by law.⁶⁵ As we found in a prior report, these transfers can affect the agencies' ability to carry out other important land management functions that are key to meeting their missions, such as restoration of forest lands

⁶³As noted, unless otherwise specified, obligations are presented in nominal dollars, or actual dollars that are not adjusted for inflation.

⁶⁴For example, to determine the fiscal year 2015 budget request for suppression, which the agencies submitted in fiscal year 2014, the agencies averaged obligations for suppression for fiscal years 2004 through 2013.

⁶⁵See, e.g., Pub. L. No. 113–76, Div. G, Interior, Environment, and Related Agencies Appropriations Act, 2014, Title I, § 102, 128 Stat. 309 (Interior); Title III, 128 Stat. 325 (Forest Service).

and other improvements.⁶⁶ For example, according to a Forest Service report, funding transfers led to a canceled fuel reduction project on the Sante Fe National Forest and the deferral of critical habitat acquisition on the Cibola National Forest, both located in New Mexico.⁶⁷

In their annual budget justifications for fiscal years 2015 and 2016, the agencies proposed an alternative mechanism to fund suppression activities. Under that proposal, the agencies would receive 70 percent of the standard 10-year average of suppression obligations as their appropriation for wildland fire suppression, which reflects the amount the agencies spend to suppress approximately 99 percent of wildland fires.⁶⁸ If suppression obligations exceed this amount, additional funds would be made available from a disaster funding account. Forest Service and Interior officials told us this proposal would allow them to better account for the variable nature of wildland fire seasons and reduce or eliminate the need to transfer funds from other accounts to pay for suppression. In addition, legislation pending in Congress would change how certain wildland fire suppression operations are funded.⁶⁹

**Forest Service and Interior
Distribute Preparedness
Funding Based in Part on
an Obsolete System They
Are Working to Replace**

The Forest Service and Interior distribute preparedness funding to their regions and agencies, respectively, based in part on information generated from a system that is now obsolete. The agencies attempted to develop a new system to distribute preparedness funding, but ended that effort in 2014 and are now working to develop different tools and systems. In distributing preparedness funds to individual forests, some Forest

⁶⁶GAO, *Wildfire Suppression: Funding Transfers Cause Project Cancellations and Delays, Strained Relationships, and Management Disruptions*, GAO-04-612 (Washington, D.C.: June 2, 2004). In this report, we suggested that Congress consider alternative funding approaches for wildfire suppression to reduce the potential need for the Forest Service and Interior to rely on transferring funds from other programs to pay for wildfire suppression.

⁶⁷Forest Service, *Fire Transfer Impact by State and Territory* (Washington, D.C.: June 2014).

⁶⁸The remaining 1 percent of wildland fires typically account for the remaining 30 percent agencies spend on suppression, according to agency documents.

⁶⁹For example, Title V of the Senate version of the Interior and Related Appropriations Act for Fiscal Year 2016 (S. 1645) would allow certain wildland fire suppression activities to be funded in a manner consistent with other natural disasters, using a modification of the approach proposed in the budget request.

Forest Service and Interior
Distribution of Preparedness
Funds to Regions and
Agencies

Service regions have developed additional tools to help them distribute funds; similarly, three of the four Interior agencies have developed additional tools to help them distribute preparedness funds to their regions.⁷⁰ Overall preparedness obligations in 2014 totaled about \$1.0 billion for the Forest Service and about \$274 million for the Interior agencies.⁷¹ (See app. II for detailed information on each of the agencies' obligations for preparedness for fiscal years 2004 through 2014.)

To determine the distribution of preparedness funds from Forest Service headquarters to its regions, and from Interior to the department's four agencies with wildland fire management responsibilities, the Forest Service and Interior rely primarily on amounts that are based on results from a budgeting system known as the National Fire Management Analysis System (NFMAS).⁷² That system, however, was terminated in the early 2000s, according to agency officials. Relying on the results from the last year NFMAS was used, and making only incremental changes from year to year, the Forest Service and Interior have not made significant shifts in the funding distribution across their respective regions and agencies over time, and they have generally maintained the same number and configuration of firefighting assets (e.g., fire engines and crews) in the same geographic areas from year to year. Several agency officials, however, told us that these amounts no longer reflect current conditions, in part because of changes to the landscape resulting from increased human development, climate change, and changes to land management policies that consider natural resource values differently than they did when NFMAS was in use.

Beginning in 2002, the agencies attempted to replace NFMAS with an interagency system designed to help them determine the optimal mix and

⁷⁰As noted, we did not assess the design or use of any of the agencies' tools or systems for distributing funds.

⁷¹Part of the difference in obligation amounts may be attributed to differences in how the Forest Service and Interior use preparedness funds to pay firefighters' salaries. See appendix III for more information about these differences.

⁷²NFMAS had two primary components. One component provided historical weather and fire behavior data, and the other analyzed various fire-management scenarios, considering different combinations of firefighting resources, various potential wildfire conditions, and various resource values (such as the presence of timber or other commodity values), to help identify the most efficient level of preparedness resources for a given land management unit.

location of firefighting assets and distribute funds accordingly. In developing this system, known as the Fire Program Analysis system, the agencies' goal was to develop "a comprehensive interagency process for fire planning and budget analysis identifying cost-effective programs to achieve the full range of fire management goals and objectives."⁷³

According to agency documents, this effort proved problematic because of the difficulty in modeling various aspects of wildland fire management. In addition, agency officials told us it is difficult to design a system that could account for multiple agencies' different needs and varying missions. After more than a decade of work, and investment that Forest Service officials estimated at approximately \$50 million, the agencies terminated the system's development in September 2014. At that time, they stated that it "only delivered inconsistent and unacceptable results."⁷⁴

Since the termination of the Fire Program Analysis system, the agencies have continued to rely on results based on the terminated NFMAS, but have begun working on new tools to help them distribute funding and assets based on current conditions and updated information. Forest Service headquarters officials told us the agency is developing a new tool called the Wildland Fire Investment Portfolio System. According to these officials, this proposed system is intended to model scenarios such as large shifts in firefighting assets, various potential dispatch procedures, and changes in fire behavior due to climate change, which will allow managers, both at the national and individual unit level, to conduct resource trade-off analyses and assess whether assets are being used effectively. Forest Service officials told us that the agency is in the early stages of developing this proposed system and anticipates using it for planning and analysis purposes in fiscal year 2016.

Interior documents state that Interior is developing a system called the Risk-Based Wildland Fire Management model, which Interior will use to help support funding distribution decisions to the four Interior agencies for both preparedness and fuel reduction. The proposed system will assess the probability and likely intensity of wildland fire, values at risk, and the

⁷³Department of the Interior and Forest Service, *FPA Closeout and Transition Plan* (Washington, D.C.: September 29, 2014).

⁷⁴Nevertheless, agency officials told us the effort resulted in some useful analytical products, including certain data sources and a large fire simulation modeling tool known as FSim.

	expected value of acres likely to burn. A key element of this system will be the development of strategic business plans by each of the four Interior agencies, detailing how each agency intends to distribute its preparedness and fuel reduction funding to reduce the risks from wildland fire on its lands. Interior officials said that, once the agencies provide these business plans, Interior will assess them in making funding distribution decisions among the agencies. According to several Interior agency officials, identifying priority values at risk across Interior's four agencies may be challenging given the variation in agency missions and the types of lands they manage. For example, a threatened species located primarily on BLM lands may be among BLM's highest priorities, but a forested area relied upon by an Indian tribe for its livelihood may be among BIA's highest priorities. Interior officials told us that they expect to identify the prioritized values and issue guidance on the proposed system by the end of calendar year 2015, and then use its results to inform their fiscal year 2016 funding distributions to the four agencies.
Forest Service Regions' Distribution to Individual National Forests	Once the Forest Service distributes preparedness funding to regions, it gives regions discretion to determine how to subsequently distribute funding to individual national forests, as long as those determinations are consistent with policy and annual budget program direction. Forest Service headquarters officials told us they do not plan to direct regions to use any specific system to help inform distributions to national forests, so that regions can have flexibility in distributing their funds and take into account local conditions and priorities. According to agency officials, most regions distribute funding to individual national forests based on historical amounts resulting from NFMAS. However, two regions have changed the way they determine funding distribution to individual national forests to better reflect current landscape conditions. The Rocky Mountain Region uses a new system that ranks each of its forests according to a "risk priority score." According to regional officials, use of the system has resulted in shifts in funding across forests in the region; for example, the officials told us they have provided additional resources to forests along Colorado's Front Range because of increased development in the WUI. The Pacific Northwest Region also uses its own funding distribution tool, which considers elements such as fire occurrence and the number of available assets to develop a weighted value for each forest in the region. The region distributes the funding proportionally based on the values calculated for each forest.
Interior Agencies' Distribution to Regional Offices	Once obtaining preparedness funds from Interior, each agency—which, as noted, have their own land management responsibilities and missions—distributes these funds to its units. Three of these agencies—

BLM, FWS, and NPS—use newer systems and current information, such as updated fuel characterization and fire occurrence data, to distribute funding to their regional offices. The fourth agency, BIA, generally uses historical-based amounts (i.e., NFMA results), but has made some changes to reflect updated priorities. The regions subsequently distribute funding to individual land units, typically using the same systems. The four agencies' approaches are described below.

- **BLM.** Since 2010, BLM officials told us they have used results from the Fire Program Decision Support System to help determine funding distributions to state offices. The system analyzes BLM's fire workload and complexity using four components: fire suppression workload, fuel types, human risk, and additional fire resources, and assigns scores to state offices accordingly. Based on the resulting analyses, BLM has shifted funding across state offices to help better reflect current conditions. BLM officials told us that most states use the new system to help inform the distribution of funding to their units. BLM is also developing an additional component of the Fire Program Decision Support System to help offices determine the appropriate number of firefighting assets needed in each area. Officials expect to apply the new component with their overall system in the fall of 2015.
- **FWS.** In 2014, FWS began distributing its preparedness funding to regions using the Preparedness Allocation Tool. Officials told us that the tool uses information such as historical wildland fire occurrence, proximity to WUI areas, and other information, to inform preparedness funding distributions to regions. Agency officials told us that results from this tool did not generally identify the need for large funding shifts across units, but rather helped identify some smaller shifts to better reflect current landscape conditions. Officials with one FWS region told us that the tool has helped the agency provide better assurance that funding amounts are risk-based and transparent.
- **NPS.** Since 2013, primarily in response to their overall wildland fire management program funding reductions, NPS began using a system called the Planning Data System to determine what level of firefighting workforce the agency could afford under different budget distribution scenarios. The system generates personnel requirements for each NPS unit by establishing a minimum number of people for any unit that meets certain criteria. Those results are rolled up to also provide regional workforce requirements. The results generated from this

system showed that some NPS regions, as well as individual park units, had existing wildland fire organizations that they could no longer adequately support in light of reduced budgets.⁷⁵

- **BIA.** BIA relies primarily on historical funding amounts derived from a system similar to NFMAS. However, BIA officials told us they have made adjustments to the historical amounts using professional judgment. BIA officials told us that the regions also still primarily use historical-based amounts to distribute funding to their units. The officials told us they will wait until Interior finalizes its Risk Based Wildland Fire Management model before they develop a new funding distribution tool.

Agencies Are Working to Distribute Fuel Reduction Funding to Better Account for Current Conditions

Beginning in 2009, the Forest Service and Interior both used systems collectively known as the Hazardous Fuels Prioritization and Allocation System (HFPAS) to distribute fuel reduction funds.⁷⁶ Officials told us these systems, based on similar concepts and approaches, were developed by the agencies to provide an interagency process for distributing fuel reduction funding to the highest-priority projects.⁷⁷ Starting in 2014, the Forest Service instead began using a new system, which, according to officials, allows the agency to more effectively distribute fuel reduction funds. Interior continues to distribute fuel reduction funding to the four agencies based on funding amounts derived from HFPAS, but it plans to develop a new system for distributing funds to reflect more current conditions and risks. Overall fuel reduction obligations in 2014 totaled about \$302 million for the Forest Service and about \$147 million for the Interior agencies. (See app. II for detailed information on the agencies' fuel reduction obligations for fiscal years 2004 through 2014.)

⁷⁵NPS officials told us they are working to refine their funding allocation process by combining results from the Planning Data System with outputs from a risk based fire occurrence and workload analysis tool that they are currently developing, the Strategic Allocation Model.

⁷⁶As noted, Interior now refers to this activity as fuel management rather than fuel reduction.

⁷⁷In 2007, we recommended that the agencies develop a systematic approach to allocating fuel reduction funding. See GAO-07-1168.

Forest Service officials told us their new system identifies locations where the highest probability of wildland fire intersects with important resources, such as residential areas and watersheds critical to municipal water supplies. These officials told us the new system allows the agency to invest its fuel reduction funds in areas where there are both a high probability of wildland fires and important resources at risk. In contrast, according to officials, HFPAS in some cases prioritized funding for areas where important resources, such as extensive WUI, existed but where the potential for wildland fires was low. The new system has identified locations for funding adjustments to Forest Service regions. For example, in 2015 the agency's Eastern and Southern Regions received a smaller proportion of fuel reduction funding than they had previously received, and some western regions saw increases, because results from the system showed that the western regions had more areas with both important resources and high wildland fire potential.

The Forest Service directs its regions to distribute fuel reduction funding to national forests using methods consistent with national information, as well as with specific local data. A senior Forest Service official told us that, as a result, most regions distribute funding to individual national forests based on information generated using HFPAS, augmented with local data. One region has developed a more updated distribution approach. Specifically, in 2012, the Rocky Mountain Region, in conjunction with the Rocky Mountain Research Station and Forest Service headquarters, developed a fuel reduction funding distribution tool that generates a risk priority score for each forest in the region. The risk priority score is based on fire probability, resources at risk from fire, potential fire intensity, and historical fire occurrence. Each forest's risk priority score is used to inform the region's distribution of funding to the national forests.

Interior currently distributes fuel reduction funding to its agencies based on the funding amounts derived from HFPAS results that were last generated in 2013. Interior officials also told us they plan to stop using HFPAS results and are planning to use the new system they are developing, the Risk-Based Wildland Fire Management model, to reflect current information on conditions and risks in distributing fuel reduction funds.

Within Interior, officials from the four agencies told us they have developed, or are in the process of developing, funding distribution systems and tools while they wait for Interior to complete the Risk-Based Wildland Fire Management model. BLM, for example, uses a fuel

reduction funding distribution tool that maps values at risk, including WUI, critical infrastructure, sagebrush habitat, and invasive species data. BLM combines this information with data on wildland fire probability to create a spatial illustration of the values at risk relative to potential fire occurrence. BLM then uses the results of this analysis to fund its state offices. BIA uses its own tool to distribute fuel reduction funding to its regions based on wildland fire potential data generated by the Forest Service. That information is then combined with fire occurrence history and workload capacity to generate a model that shows potential fire risk and capacity across BIA units. FWS officials told us they are developing a fuel reduction funding distribution tool, expected to be used for fiscal year 2016, which considers fire risks associated with each FWS unit. FWS officials told us this tool will identify risk reduction over longer periods of time, contain an accountability function to monitor results, and will share many attributes with FWS' preparedness allocation tool. NPS officials told us the agency will continue to rely on historical amounts, based largely on HFPAS. Similar to the previous Interior distribution approach, NPS distributes funding for specific projects identified at the headquarters level. However, if a unit is not able to implement an identified project, the unit can substitute other projects, as necessary.

Conclusions

Faced with the challenge of working to protect people and resources from the unwanted effects of wildland fire while also recognizing that fire is an inevitable part of the landscape, the federal wildland fire agencies have taken steps aimed at improving their approaches to wildland fire management. Their 2009 update to interagency guidance, for example, was designed to continue moving away from the agencies' decades-long emphasis on suppressing all fires, by giving fire managers more flexibility in responding to fires. In addition, the agencies are working to develop more up-to-date systems for distributing wildland fire resources. A central test of such changes, however, is the extent to which they help ensure appropriate and effective agency responses to fires when they occur. The agencies have acknowledged the importance of reviewing their responses to individual wildland fires to understand their effectiveness and identify possible improvements. However, the agencies have not systematically followed agency policy regarding such fire reviews and, in the reviews they have conducted, they have not used specific criteria in selecting fires and conducting the reviews. Officials from both the Forest Service and Interior told us cost alone should not be the basis for such reviews and have acknowledged the need to improve their criteria for selecting fires and conducting reviews. Draft guidance provided by the Forest Service did not contain specific criteria for such reviews, however,

and Interior officials did not provide information about how they planned to develop criteria or the factors they would consider. By developing specific criteria for selecting fires to review and conducting the reviews, and making commensurate changes to agency policies to help ensure the criteria are consistently applied, the agencies may enhance their ability to ensure that their fire reviews provide useful information and meaningful results. This, in turn, could better position them to identify improvements in their approach to wildland fire management and thereby use their limited resources more effectively.

Recommendations for Executive Action

To better ensure that the agencies have sufficient information to understand the effectiveness of their approach to wildland fires, and to better position them to develop appropriate and effective strategies for wildland fire management, we recommend that the Secretaries of Agriculture and the Interior direct the Chief of the Forest Service and the Director of the Office of Wildland Fire to take the following two actions:

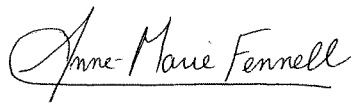
- Develop specific criteria for selecting wildland fires for review and for conducting the reviews as part of their efforts to improve their approach to reviewing fires, and
- Once such criteria are established, revise agency policies to align with the specific criteria developed by the agencies.

Agency Comments and Our Evaluation

We provided a draft of this report for review and comment to the Departments of Agriculture and the Interior. The Forest Service (responding on behalf of the Department of Agriculture) and Interior generally agreed with our findings and recommendations, and their written comments are reproduced in appendixes IV and V respectively. Both agencies stated that they are developing criteria for selecting fires to review and conducting reviews. Both agencies also provided technical comments which we incorporated into our report as appropriate. Interior also provided additional information about wildland fire technology, which we likewise incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of Agriculture and the Interior, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff members have any questions regarding this report, please contact me at (202) 512-3841 or fennella@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to the report are listed in appendix VI.

A handwritten signature in black ink that reads "Anne-Marie Fennell". The signature is written in a cursive style with a horizontal line underneath the name.

Anne-Marie Fennell
Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

This report examines (1) key changes the federal wildland fire agencies have made in their approach to wildland fire management since 2009, (2) how the agencies assess the effectiveness of their wildland fire management programs, and (3) how the agencies determine the distribution of their wildland fire management resources.

To perform this work, we reviewed laws, policies, guidance, academic literature, and reviews related to federal wildland fire management. These included the 1995 Federal Wildland Fire Management Policy and subsequent implementation guidance, the *Interagency Standards for Fire and Fire Aviation Operations*, and the 2009 and 2014 Quadrennial Fire Reviews. We also interviewed headquarters officials from each of the five federal land management agencies responsible for wildland fire management—the Forest Service in the Department of Agriculture and the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and National Park Service (NPS) in the Department of the Interior—as well as Interior’s Office of Wildland Fire.

We also conducted semistructured interviews of regional officials in each of the agencies to obtain information about issues specific to particular regions and understand differences across regions.¹ We interviewed wildland fire management program officials from each of the 9 Forest Service regional offices, 11 of BLM’s 12 state offices,² and 2 regional offices each for BIA, FWS, and NPS. We focused these regional interviews primarily on the Forest Service and BLM because those agencies receive the greatest percentage of appropriated federal wildland fire funding. For BIA, FWS, and NPS, we selected the two regions from each agency that received the most funds in those agencies—BIA’s Northwest and Western Regions, FWS’s Southwest and Southeast Regions, and NPS’s Pacific West and Intermountain Regions. We conducted a total of 25 semistructured interviews of regional offices.³

¹The Forest Service, BIA, FWS, and NPS have regional offices, while BLM has state offices. For the purposes of this report, we refer to all of these as regional offices when we discuss the agencies collectively.

²We did not interview officials from the BLM Eastern States Office because its wildland fire management program is minimal.

³The number of semistructured interviews we conducted does not match the number of regional offices identified because two Forest Service regions were included in one interview.

During these semistructured interviews we asked about (1) significant changes to the agencies' approach to wildland fire management, including regional efforts to implement the policy areas identified in the *2009 interagency Guidance for Implementation of Federal Wildland Fire Management Policy*, (2) agency efforts to assess the effectiveness of their wildland fire management activities, and (3) agency processes for determining the distribution of fire management resources. We focused our review on three primary components of wildland fire management—suppression, preparedness, and fuel reduction—because they account for the highest spending amounts among wildland fire management activities.⁴

To address our first objective, we reviewed agency documents, such as policy and guidance, as well as other documents such as agency budget justifications, to identify changes the agencies have made to their approach to managing wildland fire since 2009, efforts the agencies have undertaken to address wildland fire management challenges, agency-identified improvements resulting from those changes, and challenges associated with implementing them. Our review focuses on changes since 2009 because we last completed a comprehensive review of wildland fire management in that year, and because the agencies' last significant change to interagency wildland fire management guidance for implementing the Federal Wildland Fire Management Policy also occurred that year. To further our understanding of these issues, we also asked about these changes in our interviews with agency headquarters officials. In particular, we asked about the extent to which changes to the agencies' wildland fire management approaches have occurred or are planned, the effects of these changes, and associated challenges. In addition, we relied on the semistructured interviews of regional officials described above to understand how the regions implemented national direction and policy. We analyzed the responses provided to us during the interviews to identify common themes about prominent changes since 2009, and challenges associated with implementing those changes. The information we report represents themes that occurred frequently in our interviews with both regional and headquarters officials. We did not report on changes described during our interviews that were not directly related

⁴Other fire program components include prevention; science, research, and development; site rehabilitation; and assistance to nonfederal entities.

to wildland fire management, such as changes to general workforce management policies.

To address our second objective, we reviewed agency strategic plans and budget justifications describing performance measures, as well as other documents associated with agency efforts to assess their programs, including fire reviews. We also reviewed legislative and agency direction related to fire reviews, including agency policies and the *Interagency Standards for Fire and Fire Aviation Operations*, and reviewed reports resulting from fire reviews conducted by the agencies since 2009. We compared agency practices for conducting fire reviews to direction contained in relevant agency policy. We also interviewed headquarters officials to identify the agencies' key performance measures and the extent to which those measures reflect changing approaches to wildland fire management. In our interviews with headquarters and regional officials, we also inquired about other mechanisms the agencies use to determine the effectiveness of their wildland fire management programs, as well as any changes they are making in this area. To obtain additional insight into the use of performance information on the part of federal agencies, we also reviewed our previous reports related to agencies' use of performance information.

To address our third objective, we reviewed relevant agency budget documentation, including annual budget justifications and documentation of agency obligations, as well as information about the tools and systems the agencies use to distribute funds and resources. We did not assess the design or use of any of the agencies' tools or systems for distributing funds. We interviewed agency officials at the headquarters and regional levels to identify the processes they use for budget formulation and resource distribution. We asked about the extent to which these processes have changed in recent years at the headquarters and regional levels for each of the five agencies and the extent to which they have changed funding and resource amounts. We also obtained data from the Forest Service and from Interior's Office of Wildland Fire on obligations for each of the three primary wildland fire management components—suppression, preparedness, and fuel reduction—from fiscal years 2004 through 2014, analyzing the data in both nominal (actual) and constant (adjusted for inflation) terms. Adjusting nominal dollars to constant dollars allows the comparison of purchasing power across fiscal years. To adjust for inflation, we used the gross domestic product price index with 2014 as the base year. We reviewed budget documents and obligation data provided by the agencies, and interviewed agency officials.

knowledgeable about the data, and we found the data sufficiently reliable for the purposes of this report.

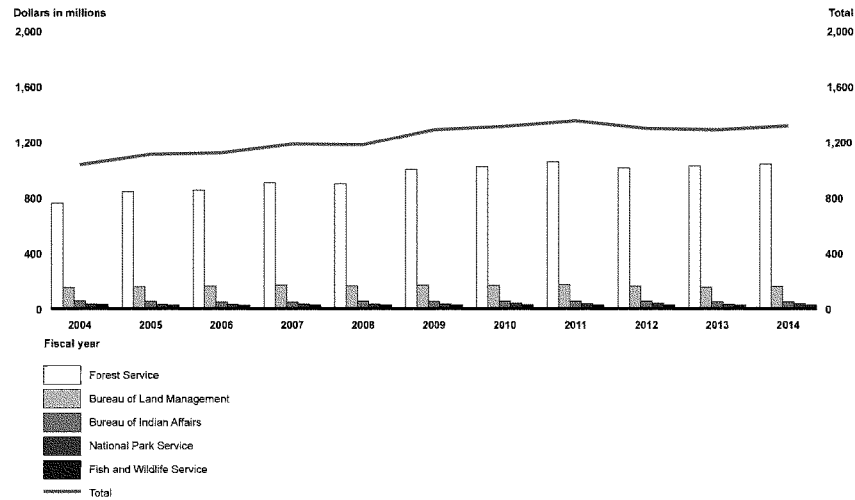
We conducted this performance audit from August 2014 to September 2015 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Forest Service and Interior Agency Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

This appendix provides information on preparedness, fuel reduction, and suppression obligations by the Forest Service and the Department of the Interior's four wildland fire agencies—the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service—for fiscal years 2004 through 2014.

Figures 4, 5, and 6 show overall agency obligations for preparedness, fuel reduction, and suppression for fiscal years 2004 through 2014. Individual agencies' obligations for each of the three programs are described later in this appendix.

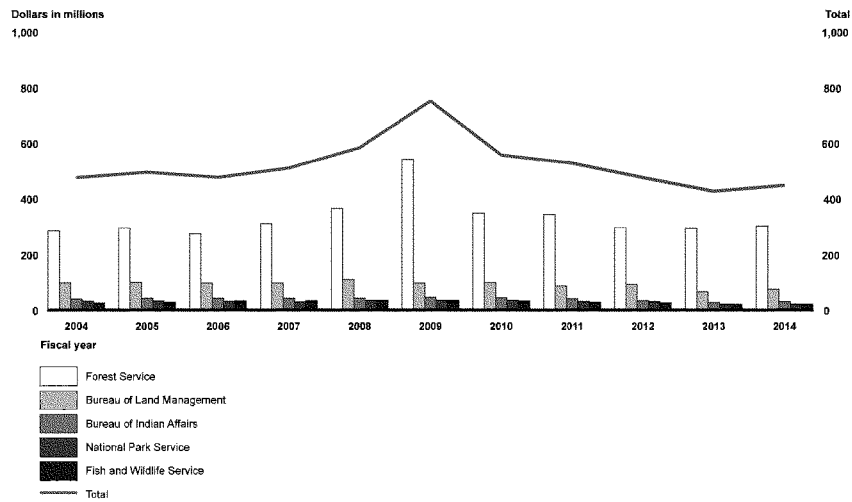
Figure 4: Forest Service and Interior Agency Wildland Fire Preparedness Obligations, Fiscal Years 2004 through 2014



Sources: GAO analysis of Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and Fish and Wildlife Service funding data. | GAO-15-772

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 5: Forest Service and Interior Agency Fuel Reduction Obligations, Fiscal Years 2004 through 2014

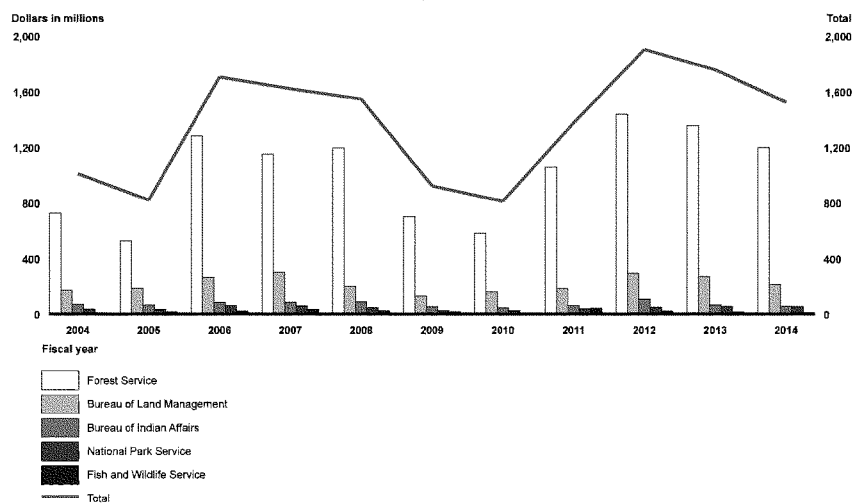


Sources: GAO analysis of Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and Fish and Wildlife Service funding data. | GAO-15-772

Note: The increase in agency obligations for fuel reduction in fiscal year 2009 was due in part to additional appropriations provided by the American Recovery and Reinvestment Act of 2009 (Pub. L. No. 111-5).

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 6: Forest Service and Interior Agency Wildland Fire Suppression Obligations, Fiscal Years 2004 through 2014



Sources: GAO analysis of Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, and Fish and Wildlife Service funding data. | GAO-15-772

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Table 1 and figure 7 show annual Forest Service wildland fire management obligations for fiscal years 2004 through 2014. Preparedness obligations increased from nearly \$760 million in fiscal year 2004 to about \$1.0 billion in fiscal year 2014, an average increase of 3.2 percent per year, or 1.2 percent after adjusting for inflation.¹ Fuel reduction obligations increased from about \$284 million in fiscal year 2004 to about \$302 million in fiscal year 2014, an average annual increase of 0.6 percent, or a 1.4 percent decrease after adjusting for inflation. Suppression obligations fluctuated from year to year, with a high of about \$1.4 billion in fiscal year 2012 and a low of about \$525 million in fiscal year 2005.

Table 1: Forest Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Dollars in millions								
Fiscal year	Preparedness		Fuel reduction		Suppression		Total	
	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted
2004	\$759.3	\$927.1	\$284.2	\$347.0	\$726.0	\$886.4	\$1,769.6	\$2,160.6
2005	841.2	995.7	294.5	348.6	524.9	621.3	1,660.6	1,965.7
2006	852.8	977.7	274.3	314.5	1,280.4	1,468.0	2,407.5	2,760.1
2007	905.6	1,010.7	310.6	346.7	1,149.7	1,283.2	2,365.8	2,640.5
2008	898.4	982.4	364.5	398.6	1,193.1	1,304.6	2,456.0	2,685.6
2009	1,002.2	1,083.3	541.6	585.4	702.1	758.9	2,245.9	2,427.5
2010	1,021.8	1,094.9	348.2	373.1	578.3	619.6	1,948.3	2,087.6
2011	1,057.4	1,110.4	343.6	360.8	1,055.7	1,108.7	2,456.7	2,579.9
2012	1,013.2	1,045.0	295.3	304.6	1,436.6	1,481.8	2,745.1	2,831.4
2013	1,026.7	1,042.4	293.7	298.2	1,356.5	1,377.3	2,676.9	2,717.9
2014	1,040.0	1,040.0	301.7	301.7	1,196.0	1,196.0	2,537.7	2,537.7

Source: GAO analysis of Forest Service funding data. | GAO-15-772

Notes: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.
Totals may not add due to rounding.

¹According to Forest Service budget justifications, the Forest Service shifted aviation costs from the suppression account to the preparedness account beginning in fiscal year 2012. The Forest Service has retroactively adjusted the figures in both of these accounts for fiscal years 2005 through fiscal year 2011 to reflect this correction and allow comparability of numbers before and after this shift.

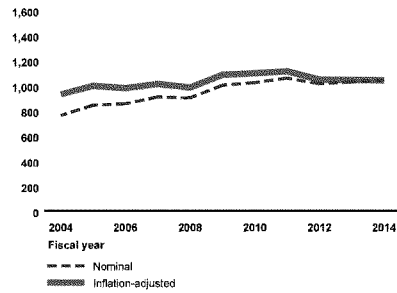
Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 7: Forest Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Forest Service (obligations)

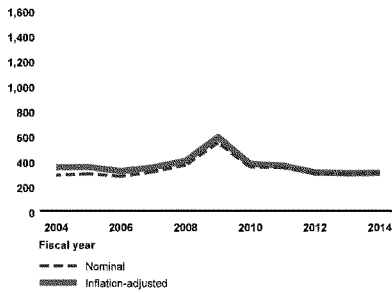
Preparedness

Dollars in millions



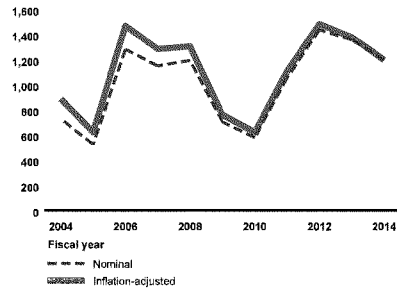
Fuel reduction

Dollars in millions



Suppression

Dollars in millions



Source: GAO analysis of Forest Service funding data. | GAO-15-772

Note: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Table 2 and figure 8 show annual Bureau of Indian Affairs wildland fire management obligations for fiscal years 2004 through 2014. Preparedness obligations decreased from nearly \$58 million in fiscal year 2004 to about \$51 million in fiscal year 2014, an average annual decrease of 1.3 percent per year, or 3.2 percent after adjusting for inflation. Fuel reduction obligations decreased from about \$39 million in fiscal year 2004 to about \$30 million in fiscal year 2014, an average annual decrease of 2.6 percent, or 4.5 percent after adjusting for inflation. Suppression obligations fluctuated from year to year, with a high of about \$105 million in fiscal year 2012 and a low of about \$43 million in fiscal year 2010.

Table 2: Bureau of Indian Affairs Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Dollars in millions

Fiscal year	Preparedness		Fuel reduction		Suppression		Total	
	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted
2004	\$57.6	\$70.3	\$38.7	\$47.2	\$67.5	\$82.4	\$163.8	\$200.0
2005	53.0	62.8	41.8	49.5	62.4	73.9	157.3	186.2
2006	48.5	55.6	41.7	47.8	82.9	95.1	173.1	198.5
2007	47.7	53.2	41.5	46.3	83.1	92.7	172.2	192.2
2008	55.0	60.1	41.7	45.6	87.9	96.2	184.6	201.8
2009	52.3	56.5	44.6	48.2	51.1	55.2	147.9	159.9
2010	54.4	58.3	43.2	46.3	43.2	46.3	140.8	150.8
2011	56.2	59.1	39.7	41.7	58.5	61.4	154.5	162.2
2012	54.8	56.6	33.0	34.0	105.4	108.7	193.1	199.2
2013	49.3	50.0	26.1	26.5	63.6	64.6	139.0	141.2
2014	50.8	50.8	29.7	29.7	53.2	53.2	133.7	133.7

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Notes: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Totals may not add due to rounding.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 8: Bureau of Indian Affairs Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Bureau of Indian Affairs (obligations)

Preparedness

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Fuel reduction

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Suppression

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Note: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Table 3 and figure 9 show annual Bureau of Land Management wildland fire management obligations from fiscal years 2004 through 2014. Preparedness obligations increased from nearly \$152 million in fiscal year 2004 to about \$160 million in fiscal year 2014, an average annual increase of 0.6 percent per year, or a 1.4 percent decrease after adjusting for inflation. Fuel reduction obligations decreased from about \$98 million in fiscal year 2004 to about \$75 million in fiscal year 2014, an average annual decrease of 2.6 percent, or 4.6 percent after adjusting for inflation. Suppression obligations fluctuated from year to year, with a high of about \$299 million in fiscal year 2007 and a low of about \$130 million in fiscal year 2009.

Table 3: Bureau of Land Management Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Dollars in millions

Fiscal year	Preparedness		Fuel reduction		Suppression		Total	
	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted
2004	\$151.6	\$185.1	\$97.7	\$119.3	\$170.5	\$208.1	\$419.8	\$512.5
2005	157.6	186.6	99.2	117.4	184.4	218.2	441.2	522.2
2006	162.2	185.9	97.2	111.4	262.7	301.2	522.1	598.5
2007	168.7	188.3	96.6	107.8	298.5	333.1	563.8	629.3
2008	163.3	178.6	109.4	119.6	198.0	216.5	470.7	514.7
2009	169.6	183.3	96.8	104.6	129.9	140.5	396.3	428.3
2010	166.2	178.0	98.3	105.4	160.0	171.4	424.5	454.8
2011	171.9	180.5	86.6	90.9	182.6	191.8	441.1	463.3
2012	161.1	166.2	91.8	94.7	292.2	301.3	545.1	562.2
2013	153.3	155.7	66.1	67.1	268.2	272.3	487.6	495.1
2014	160.2	160.2	74.8	74.8	211.3	211.3	446.4	446.4

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Notes: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.
Totals may not add due to rounding.

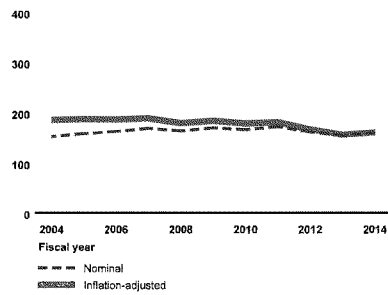
Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 9: Bureau of Land Management Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Bureau of Land Management (obligations)

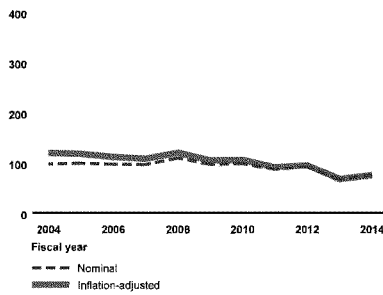
Preparedness

Dollars in millions



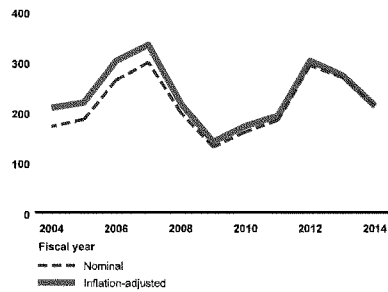
Fuel reduction

Dollars in millions



Suppression

Dollars in millions



Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Note: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Table 4 and figure 10 show annual Fish and Wildlife Service wildland fire management obligations for fiscal years 2004 through 2014. Preparedness obligations decreased from about \$33 million in fiscal year 2004 to about \$27 million in fiscal year 2014, an average annual decrease of 2.1 percent per year, or 4.1 percent after adjusting for inflation. Fuel reduction obligations decreased from about \$24 million in fiscal year 2004 to about \$21 million in fiscal year 2014, an average annual decrease of 1.5 percent, or 3.5 percent after adjusting for inflation. Suppression obligations fluctuated from year to year, with a high of about \$41 million in fiscal year 2011 and a low of about \$4 million in fiscal year 2010.

Table 4: Fish and Wildlife Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Dollars in millions

Fiscal year	Preparedness		Fuel reduction		Suppression		Total	
	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted
2004	\$33.4	\$40.7	\$24.2	\$29.6	\$8.4	\$10.3	\$66.0	\$80.6
2005	26.8	31.7	27.9	33.0	14.3	16.9	69.0	81.7
2006	25.6	29.3	33.0	37.8	19.9	22.9	78.5	90.0
2007	27.7	30.9	33.0	36.8	31.4	35.1	92.1	102.8
2008	28.4	31.1	33.9	37.1	22.5	24.6	84.9	92.8
2009	28.2	30.5	34.8	37.6	15.0	16.2	78.0	84.4
2010	29.4	31.5	32.6	34.9	4.3	4.6	66.3	71.0
2011	29.0	30.4	27.5	28.8	40.5	42.6	97.0	101.8
2012	27.9	28.8	25.5	26.3	20.8	21.4	74.2	76.5
2013	25.9	26.3	20.2	20.5	14.1	14.3	60.2	61.1
2014	26.9	26.9	20.7	20.7	9.4	9.4	57.0	57.0

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Notes: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Totals may not add due to rounding.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 10: Fish and Wildlife Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Fish and Wildlife Service (obligations)

Preparedness

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Fuel reduction

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Suppression

Dollars in millions

150

100

50

0

Fiscal year

--- Nominal
--- Inflation-adjusted

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Note: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Table 5 and figure 11 show annual National Park Service wildland fire management obligations for fiscal years 2004 through 2014. Obligations for preparedness increased from about \$35 million in fiscal year 2004 to about \$36 million in fiscal year 2014, an average annual increase of 0.5 percent per year, or a 1.5 percent decrease after adjusting for inflation. Fuel reduction obligations decreased from about \$31 million in fiscal year 2004 to about \$21 million in fiscal year 2014, an average annual decrease of 3.7 percent, or 5.6 percent after adjusting for inflation. Suppression obligations fluctuated from year to year, with a high of about \$58 million in fiscal year 2006 and a low of about \$22 million in fiscal year 2009.

Table 5: National Park Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

Dollars in millions

Fiscal year	Preparedness		Fuel reduction		Suppression		Total	
	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted	Nominal	Inflation-adjusted
2004	\$34.6	\$42.2	\$31.1	\$38.0	\$34.9	\$42.6	\$100.6	\$122.8
2005	31.5	37.3	31.8	37.7	32.9	39.0	96.3	114.0
2006	31.9	36.6	30.9	35.4	58.5	67.0	121.2	139.0
2007	34.1	38.1	28.6	31.9	57.4	64.1	120.1	134.1
2008	33.9	37.1	33.9	37.0	44.3	48.5	112.1	122.6
2009	34.4	37.2	33.9	36.6	22.4	24.2	90.6	98.0
2010	39.7	42.5	34.4	36.8	23.7	25.4	97.8	104.7
2011	36.4	38.2	30.3	31.8	37.0	38.9	103.7	108.9
2012	39.3	40.6	30.4	31.3	47.4	48.9	117.1	120.8
2013	31.0	31.5	21.0	21.3	53.1	53.9	105.2	106.8
2014	36.2	36.2	21.4	21.4	52.2	52.2	109.8	109.8

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Notes: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

Totals may not add due to rounding.

Appendix II: Forest Service and Interior
Agency Obligations for Preparedness, Fuel
Reduction, and Suppression, Fiscal Years
2004 through 2014

Figure 11: National Park Service Wildland Fire Obligations for Preparedness, Fuel Reduction, and Suppression, Fiscal Years 2004 through 2014

National Park Service (obligations)

Preparedness

Dollars in millions

150

100

50

0

Fiscal year

2004 2006 2008 2010 2012 2014

--- Nominal
--- Inflation-adjusted

Fuel reduction

Dollars in millions

150

100

50

0

Fiscal year

2004 2006 2008 2010 2012 2014

--- Nominal
--- Inflation-adjusted

Suppression

Dollars in millions

150

100

50

0

Fiscal year

2004 2006 2008 2010 2012 2014

--- Nominal
--- Inflation-adjusted

Source: GAO analysis of Department of the Interior funding data. | GAO-15-772

Note: Inflation-adjusted figures represent obligations in fiscal year 2014 dollars.

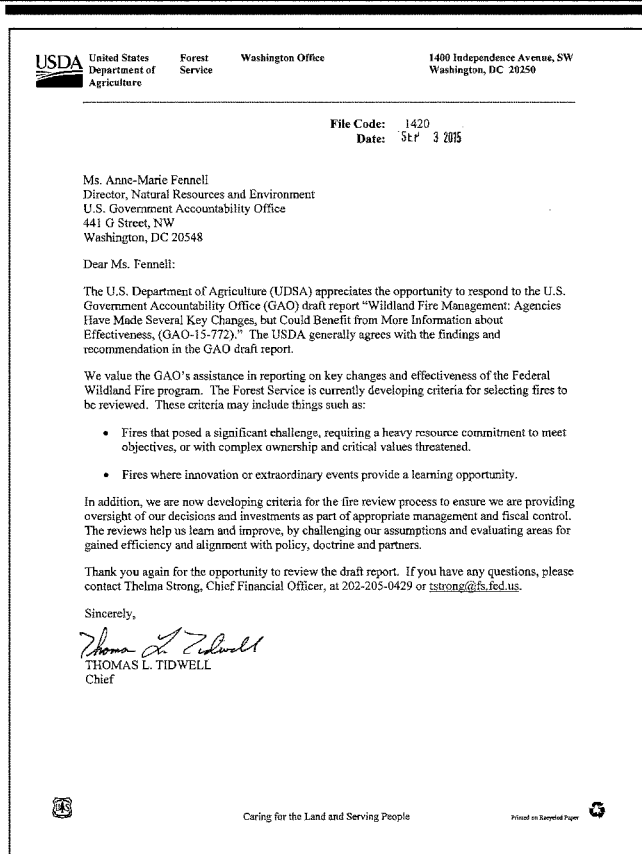
Appendix III: Differences in Forest Service and Department of the Interior Salary Payments Using Preparedness and Suppression Funding

The Forest Service and the Department of the Interior use different approaches for paying the base salaries of their staff during wildland fire incidents.¹ For periods when firefighters are dispatched to fight fires, the Forest Service generally pays its firefighters' base salaries using *suppression* funds, whereas Interior pays its firefighters' base salaries primarily using *preparedness* funds.² Forest Service officials told us that under this approach, regional offices, which are responsible for hiring firefighters in advance of the fire season, routinely hire more firefighters than their preparedness budgets will support, assuming they can rely on suppression funds to pay the difference. Forest Service officials told us that their funding approach helps the agency maintain its firefighting capability over longer periods of time during a season and accurately track the overall costs of fires. Interior officials told us they choose to use preparedness funds to pay their firefighters' base salaries during a wildland fire because it constitutes a good business practice. According to a Wildland Fire Leadership Council document, in 2003, the council agreed that the agencies would use a single, unified approach and pay firefighters' base salary using Interior's method of using preparedness funds. However, the council subsequently noted that in 2004 the Office of Management and Budget directed the Forest Service to continue using suppression funds to pay firefighters' base salaries. The agencies have used separate approaches since 2004.

¹Base salary represents the salary paid for a standard 8-hour work shift.

²Interior uses preparedness funds to pay for its firefighters' standard 8-hour work shift on a wildland fire, and suppression funds to pay for any overtime. The Forest Service uses suppression funds to pay for any time a firefighter spends on a wildland fire.

Appendix IV: Comments from the Department of Agriculture



Appendix V: Comments from the Department of the Interior



United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

SEP 04 2015

Ms. Anne-Marie Fennell
Director, Natural Resources and Environment
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Fennell:

Thank you for providing the Department of the Interior (Department) the opportunity to review and comment on the draft Government Accountability Office (GAO) Report entitled *Wildland Fire Management: Agencies Have Made Several Key Changes, but Could Benefit from More Information about Effectiveness* (GAO-15-772). We appreciate GAO's review of the key changes in the agencies' approach to wildland fire management since 2009 and their effectiveness.

This report underscores the success of the interagency wildland fire management program. The Department of the Interior is proud to be part of this ongoing effort to provide safe and effective protection and response to wildfires, to promote healthy and resilient forest and rangeland landscapes, and to strengthen the resilience of communities to wildland fire. We are committed to continuing to work with our interagency and intergovernmental partners to improve policy and program delivery.

We are requesting an addition to the factual portion of the report, one technical comment in "What GAO Found," and a comment on the phrasing of the recommendations.

1. Addition to the factual portion of the Report

GAO did not include an important component of work to improve information and technology in support of the wildland fire management program (page 22 of the draft report) in the report. The Departments of the Interior and Agriculture are working together to take a common, integrated approach to information and technology management. This effort began in 2012. We would like the following text added to the report at the end of this section:

The report titled "Wildland Fire Information and Technology - Strategy, Governance, and Investments" was reviewed and accepted jointly by senior leadership in DOI and the Forest Service on March 23, 2012. Formal implementation of this effort was put into place on August 24, 2012, again, jointly by DOI and the Forest Service. This involved developing and implementing a common wildland fire information and technology vision and strategy for use in evaluating current and new investments and developing a single, interagency governance process for managing and overseeing those investments. The two Departments entered into a Memorandum of

Appendix V: Comments from the Department
of the Interior

Understanding that establishes a common management and governance approach for standardizing business processes and providing standardized information and technology services in a timely, consistent, reliable, integrated, innovative, and cohesive manner to meet business requirements and priorities of the wildland fire business community. Senior leadership in both the agencies report that they are completing a multi-year integrated investment strategy for wildland fire applications and supporting infrastructure.

2. Technical comment on "What GAO Found" in the summary page

We suggest the following to replace the second and third sentences:

One key change was the issuance of guidance in 2009 on implementing the Interagency Federal Wildland Fire Management Working Group's January 2001 "Review and Update of the 1995 Federal Wildland Fire Management Policy" that provided managers with more flexibility in responding to wildland fires. This change allowed managers to consider strategic management options, in the context of the risk posed by the wildfire, ensuring that the selected course of action is consistent with land management objectives.

3. Recommendations

The GAO issued two recommendations to the Department in response to its overall findings. We generally agree with the findings and concur with the recommendations and offer the following responses.

Recommendation 1: To better ensure that the agencies have sufficient information to understand the effectiveness of their approach to wildland fires, and to better position them to develop appropriate and effective strategies for wildland fire management, we recommend that the Secretary of the Interior direct the Directors of BIA, BLM, FWS, and NPS develop specific criteria for selecting wildland fires for review and for conducting the reviews as part of their efforts to improve their approach to reviewing fires.

The responsibility for Department-wide wildland fire policy rests with the Office of Wildland Fire, and therefore, we request revising Recommendation 1 as follows (new wording in *italics*):

Recommendation 1: To better ensure that the agencies have sufficient information to understand the effectiveness of their approach to wildland fires, and to better position them to develop appropriate and effective strategies for wildland fire management, we recommend that the Secretary of the Interior direct the *Office of Wildland Fire* develop specific criteria for selecting wildland fires for review and for conducting the reviews as part of *the Department of the Interior* efforts to improve its approach to reviewing fires, *in coordination with the Forest Service*.

Response: The Department continues to undertake steps to understand the effectiveness of its actions including a recently completed examination of "Large Fire Cost Reviews." From this examination we identified a number of substantive procedural issues that are

Appendix V: Comments from the Department
of the Interior

fundamental for the Department's Office of Wildland Fire to formulate new criteria for reviewing wildland fires in the context of protecting life, property, and resource values, as well as other public benefits, such as landscapes that are resilient to impacts from wildfire. In addition, the BLM established a process in 2015 for conducting large fire assessments for wildfires occurring in sage grouse habitat. The Office of Wildland Fire is reviewing current policies and practices for conducting fire reviews and will be developing Department-wide standards and criteria in collaboration with the Forest Service.

Recommendation 2: To better ensure that the agencies have sufficient information to understand the effectiveness of their approach to wildland fires, and to better position them to develop appropriate and effective strategies for wildland fire management, we recommend that the Secretary of the Interior direct the Directors of BIA, BLM, FWS, and NPS, revise agency policies to align with the specific criteria developed by the agencies.

The responsibility for Department-wide wildland fire policy rests with the Office of Wildland Fire. Thus we request revising Recommendation 2 as follows (new wording in *italics*):

Recommendation 2: To better ensure that the agencies have sufficient information to understand the effectiveness of their approach to wildland fires, and to better position them to develop appropriate and effective strategies for wildland fire management, we recommend that the Secretary of the Interior direct the *Office of Wildland Fire* revise *Department wildland fire management policy* to align with the specific criteria developed in *Recommendation 1*.

Response: The Department recognizes the limitations of current standards for review of wildland fire and initiated discussions with the Forest Service about coordinating revised policy direction. Both Departments seek to compile sufficient information to understand the effectiveness of their wildland fire program activities, which will include policy revision that articulates the purpose, objectives, criteria, and methodology for incorporating review information into current and future program activities.

If you have any questions, or need additional information, please contact me.

Sincerely,



Kristin J. Sarri
Principal Deputy Assistant Secretary
Policy, Management and Budget

Appendix VI: GAO Contact and Staff Acknowledgments

GAO Contact

Anne-Marie Fennell, (202) 512-3841 or fennella@gao.gov

Staff Acknowledgments

In addition to the individual named above, Steve Gaty (Assistant Director), Ulana M. Bihun, Richard P. Johnson, Lesley Rinner, and Kyle M. Stetler made key contributions to this report. Important contributions were also made by Cheryl Arvidson, Mark Braza, William Carrigg, Carol Henn, Benjamin T. Licht, Armetha Liles, and Kiki Theodoropoulos.

Related GAO Products

Wildland Fire Management: Improvements Needed in Information, Collaboration, and Planning to Enhance Federal Fire Aviation Program Success. GAO-13-684. Washington, D.C.: August 20, 2013.

Station Fire: Forest Service's Response Offers Potential Lessons for Future Wildland Fire Management. GAO-12-155. Washington, D.C.: December 16, 2011.

Arizona Border Region: Federal Agencies Could Better Utilize Law Enforcement Resources in Support of Wildland Fire Management Activities. GAO-12-73. Washington, D.C.: November 8, 2011.

Wildland Fire Management: Federal Agencies Have Taken Important Steps Forward, but Additional Action Is Needed to Address Remaining Challenges. GAO-09-906T. Washington, D.C.: July 21, 2009.

Wildland Fire Management: Federal Agencies Have Taken Important Steps Forward, but Additional, Strategic Action Is Needed to Capitalize on Those Steps. GAO-09-877. Washington, D.C.: September 9, 2009.

Wildland Fire Management: Actions by Federal Agencies and Congress Could Mitigate Rising Fire Costs and Their Effects on Other Agency Programs. GAO-09-444T. Washington, D.C.: April 1, 2009.

Forest Service: Emerging Issues Highlight the Need to Address Persistent Management Challenges. GAO-09-443T. Washington, D.C.: March 11, 2009.

Wildland Fire Management: Interagency Budget Tool Needs Further Development to Fully Meet Key Objectives. GAO-09-68. Washington, D.C.: November 24, 2008.

Wildland Fire Management: Federal Agencies Lack Key Long- and Short-Term Management Strategies for Using Program Funds Effectively. GAO-08-433T. Washington, D.C.: February 12, 2008.

Forest Service: Better Planning, Guidance, and Data Are Needed to Improve Management of the Competitive Sourcing Program. GAO-08-195. Washington, D.C.: January 22, 2008.

Wildland Fire Management: Better Information and a Systematic Process Could Improve Agencies' Approach to Allocating Fuel Reduction Funds

Related GAO Products

and Selecting Projects. GAO-07-1168. Washington, D.C.: September 28, 2007.

Natural Hazard Mitigation: Various Mitigation Efforts Exist, but Federal Efforts Do Not Provide a Comprehensive Strategic Framework. GAO-07-403. Washington, D.C.: August 22, 2007.

Wildland Fire: Management Improvements Could Enhance Federal Agencies' Efforts to Contain the Costs of Fighting Fires. GAO-07-922T. Washington, D.C.: June 26, 2007.

Wildland Fire Management: A Cohesive Strategy and Clear Cost-Containment Goals Are Needed for Federal Agencies to Manage Wildland Fire Activities Effectively. GAO-07-1017T. Washington, D.C.: June 19, 2007.

Wildland Fire Management: Lack of Clear Goals or a Strategy Hinders Federal Agencies' Efforts to Contain the Costs of Fighting Fires. GAO-07-655. Washington, D.C.: June 1, 2007.

Department of the Interior: Major Management Challenges. GAO-07-502T. Washington, D.C.: February 16, 2007.

Wildland Fire Management: Lack of a Cohesive Strategy Hinders Agencies' Cost-Containment Efforts. GAO-07-427T. Washington, D.C.: January 30, 2007.

Biscuit Fire Recovery Project: Analysis of Project Development, Salvage Sales, and Other Activities. GAO-06-967. Washington, D.C.: September 18, 2006.

Wildland Fire Rehabilitation and Restoration: Forest Service and BLM Could Benefit from Improved Information on Status of Needed Work. GAO-06-670. Washington, D.C.: June 30, 2006.

Wildland Fire Suppression: Better Guidance Needed to Clarify Sharing of Costs between Federal and Nonfederal Entities. GAO-06-896T. Washington, D.C.: June 21, 2006.

Wildland Fire Suppression: Lack of Clear Guidance Raises Concerns about Cost Sharing between Federal and Nonfederal Entities. GAO-06-570. Washington, D.C.: May 30, 2006.

Related GAO Products

Wildland Fire Management: Update on Federal Agency Efforts to Develop a Cohesive Strategy to Address Wildland Fire Threats. GAO-06-671R. Washington, D.C.: May 1, 2006.

Natural Resources: Woody Biomass Users' Experiences Provide Insights for Ongoing Government Efforts to Promote Its Use. GAO-06-694T. Washington, D.C.: April 27, 2006.

Natural Resources: Woody Biomass Users' Experiences Offer Insights for Government Efforts Aimed at Promoting Its Use. GAO-06-336. Washington, D.C.: March 22, 2006.

Wildland Fire Management: Timely Identification of Long-Term Options and Funding Needs Is Critical. GAO-05-923T. Washington, D.C.: July 14, 2005.

Natural Resources: Federal Agencies Are Engaged in Numerous Woody Biomass Utilization Activities, but Significant Obstacles May Impede Their Efforts. GAO-05-741T. Washington, D.C.: May 24, 2005.

Natural Resources: Federal Agencies Are Engaged in Various Efforts to Promote the Utilization of Woody Biomass, but Significant Obstacles to Its Use Remain. GAO-05-373. Washington, D.C.: May 13, 2005.

Technology Assessment: Protecting Structures and Improving Communications during Wildland Fires. GAO-05-380. Washington, D.C.: April 26, 2005.

Wildland Fire Management: Progress and Future Challenges, Protecting Structures, and Improving Communications. GAO-05-627T. Washington, D.C.: April 26, 2005.

Wildland Fire Management: Forest Service and Interior Need to Specify Steps and a Schedule for Identifying Long-Term Options and Their Costs. GAO-05-353T. Washington, D.C.: February 17, 2005.

Wildland Fire Management: Important Progress Has Been Made, but Challenges Remain to Completing a Cohesive Strategy. GAO-05-147. Washington, D.C.: January 14, 2005.

Wildland Fires: Forest Service and BLM Need Better Information and a Systematic Approach for Assessing the Risks of Environmental Effects. GAO-04-705. Washington, D.C.: June 24, 2004.

Related GAO Products

Federal Land Management: Additional Guidance on Community Involvement Could Enhance Effectiveness of Stewardship Contracting. GAO-04-652. Washington, D.C.: June 14, 2004.

Wildfire Suppression: Funding Transfers Cause Project Cancellations and Delays, Strained Relationships, and Management Disruptions. GAO-04-612. Washington, D.C.: June 2, 2004.

Biscuit Fire: Analysis of Fire Response, Resource Availability, and Personnel Certification Standards. GAO-04-426. Washington, D.C.: April 12, 2004.

Forest Service: Information on Appeals and Litigation Involving Fuel Reduction Activities. GAO-04-52. Washington, D.C.: October 24, 2003.

Geospatial Information: Technologies Hold Promise for Wildland Fire Management, but Challenges Remain. GAO-03-1047. Washington, D.C.: September 23, 2003.

Geospatial Information: Technologies Hold Promise for Wildland Fire Management, but Challenges Remain. GAO-03-1114T. Washington, D.C.: August 28, 2003.

Wildland Fire Management: Additional Actions Required to Better Identify and Prioritize Lands Needing Fuels Reduction. GAO-03-805. Washington, D.C.: August 15, 2003.

Wildland Fires: Forest Service's Removal of Timber Burned by Wildland Fires. GAO-03-808R. Washington, D.C.: July 10, 2003.

Forest Service: Information on Decisions Involving Fuels Reduction Activities. GAO-03-689R. Washington, D.C.: May 14, 2003.

Wildland Fires: Better Information Needed on Effectiveness of Emergency Stabilization and Rehabilitation Treatments. GAO-03-430. Washington, D.C.: April 4, 2003.

Major Management Challenges and Program Risks: Department of the Interior. GAO-03-104. Washington, D.C.: January 1, 2003.

Results-Oriented Management: Agency Crosscutting Actions and Plans in Border Control, Flood Mitigation and Insurance, Wetlands, and

Related GAO Products

Wildland Fire Management. GAO-03-321. Washington, D.C.: December 20, 2002.

Wildland Fire Management: Reducing the Threat of Wildland Fires Requires Sustained and Coordinated Effort. GAO-02-843T. Washington, D.C.: June 13, 2002.

Wildland Fire Management: Improved Planning Will Help Agencies Better Identify Fire-Fighting Preparedness Needs. GAO-02-158. Washington, D.C.: March 29, 2002.

Severe Wildland Fires: Leadership and Accountability Needed to Reduce Risks to Communities and Resources. GAO-02-259. Washington, D.C.: January 31, 2002.

Forest Service: Appeals and Litigation of Fuel Reduction Projects. GAO-01-1114R. Washington, D.C.: August 31, 2001.

The National Fire Plan: Federal Agencies Are Not Organized to Effectively and Efficiently Implement the Plan. GAO-01-1022T. Washington, D.C.: July 31, 2001.

Reducing Wildfire Threats: Funds Should be Targeted to the Highest Risk Areas. GAO/T-RCED-00-296. Washington, D.C.: September 13, 2000.

Fire Management: Lessons Learned From the Cerro Grande (Los Alamos) Fire. GAO/T-RCED-00-257. Washington, D.C.: August 14, 2000.

Fire Management: Lessons Learned From the Cerro Grande (Los Alamos) Fire and Actions Needed to Reduce Fire Risks. GAO/T-RCED-00-273. Washington, D.C.: August 14, 2000.

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 website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube. Subscribe to our RSS Feeds or E-mail Updates. Listen to our Podcasts and read The Watchblog. Visit GAO on the web at www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs**Contact**

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: fraudnet@gao.gov

Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800, U.S. Government Accountability Office, 441 G Street NW, Room 7149, Washington, DC 20548



Please Print on Recycled Paper.

STATEMENT FOR THE SENATE COMMITTEE ON ENERGY AND NATURAL
RESOURCES HEARING RECORD

SUBMISSION MADE ON BEHALF OF THE CALIFORNIA FOREST AND
WATERSHED ALLIANCE (CAFWA)

November 17, 2015

Chairwoman Murkowski, Ranking Member Cantwell, and Committee Members, the California Forest and Watershed Alliance (CAFWA) is pleased to submit this statement for the record for the November 17, 2015 hearing to review past wildfire seasons to inform and improve future federal wildland fire management strategies. CAFWA is a unique alliance of disparate interests including organizations that represent water, environment, local government, timber, and agricultural interests all dedicated to finding a solution to California's ever-growing forest health and fire risk issues. The members of CAFWA, the Association of California Water Agencies, California Farm Bureau Federation, California Forestry Association, The Nature Conservancy California Chapter, and Rural County Representatives of California, are working together to seek new ways to promote proactive, science-based, and ecologically sound forest management practices that will reduce the risk of destructive megafires. Our goal is to protect our forests, our natural resources, and our local economies by accelerating the pace and scale of forest restoration.

Background: Accelerating forest restoration and hazardous fuels reduction is essential to securing multiple benefits from our National Forests. These benefits include wildlife habitat, clean water supplies, recreation, forest products, carbon sequestration, forest health, reduced burned acres in wildfires and reduced fire severity, and healthy rural communities and economies.

Inaction on forest health is contributing to catastrophic megafires. CAFWA encourages Congress and the U.S. Forest Service to quickly address the known budgetary and policy obstacles that are contributing to this crisis.

CAFWA believes that any policy or legislative reforms that promote improvements to and expansion of forest restoration activities should be ecologically sound, and advance research to improve the state of scientific knowledge to better direct future land management decisions.

Problem Statement: California forests, and other forests across the western United States, are at serious risk of large, high-severity wildfires that threaten lives, communities, water resources, wildlife habitat, and recreation. Recent examples, such as the Butte and Valley Fires which were both federally declared disasters, and together destroyed over 2200 homes, infrastructure, and unique habitats and have left behind communities which will remain fractured for years to come in their wakes. Although forest thinning and controlled burning are proven methods of reducing the risk of destructive megafires, the current pace and scale of forest management activities are inadequate given the scope of the problem. Our fire season is starting earlier and lasting longer with fires burning hotter than ever before. The growing cost of Forest Service fire suppression

activities is negatively impacting the budget available to carry out critical restoration projects that protect forests and will reduce firefighting costs over the long term. Severe drought in western states is also exacerbating the decline of forests due to beetle bark infestations. There is an urgent need to restore our forests to a more resilient condition to protect our water resources, communities, and ecological values.

2015 Wildfire and Budget Impacts: According to the California Department of Forestry and Fire Protection (CAL FIRE), almost 306,000 acres of private and state land and another 400,000 acres of federal lands have been affected by wildfires this year alone and the state estimates that \$209 million will be spent, just in suppression costs. Similarly, at the national level, the U.S. Forest Service estimates that this year it will spend 52% of its entire budget on wildfires, with that amount expected to increase to 67% by 2025. Contrast that to 1995, when the Forest Service spent 16% of its budget on wildfire costs; such drastic increases in the percentage of their budget that is used for fighting fires cuts into non-fire programs such as restoration and land management, which, in turn, increases the likelihood of catastrophic wildfires the following year.

CAFWA Statement of Purpose: CAFWA believes healthy forests matter, not just to those living in and around those forests, but to all Californians who rely on clean water, clean air and recreational opportunities. The impacts of forest wildfires on our water, energy, environment and economy are felt by Californians throughout the state. It is time to take a serious look at current forest management policies, and to expand programs to improve forest health. The members of CAFWA are working together to seek new ways to promote proactive, science-based, and ecologically sound forest management practices that will reduce the risk of destructive megafires.

WHAT'S AT RISK?

Water Supply and Storage: Unhealthy forests and catastrophic wildfires affect the short and long term management and sustainability of water supplies. Wildfires in untreated areas cause burned areas to produce increased loads of sediment, ash and debris which cause reservoirs to fill up faster and reduce the life and storage capacity of reservoirs. Burned watersheds without trees and ground cover will result in snowpack melting more quickly. The resulting runoff will be less predictable, and less timely, increasing the difficulty of managing water supply throughout the west.

A recent study by The Nature Conservancy (TNC) analyzed the potential water yield benefits from ecologically-based forest management in the northern Sierra Nevada and concluded that, if conducted at a landscape scale, fuels reduction in Sierra forests can potentially increase water yield by up to 6 percent. Dr. Roger Bales (UC Merced) in his 11/29/2011 publication predicts that up to 16% could be increased in water yield. The TNC report also found that it makes economic sense for water suppliers and utilities to invest in ecologically based thinning. Increased water that comes from thinning small trees could have significant economic benefits for downstream hydropower and water users, potentially off-setting between one-third and the full cost of the thinning.

Water Quality: Post-fire flooding has short and long-term impacts throughout watersheds which can extend far beyond the area of the fire. Ash, sediment, nitrogen and phosphorus can severely impact the taste and purity of drinking water, and negatively impact fish and other aquatic species that require clear, oxygenated water. Increased sediment deposited behind reservoirs can impact the taste, clarity and odor of water as dissolved organics increase in the water, requiring elevated water treatment costs.

Ecosystem and Wildlife: Destructive megafires have numerous impacts on the ecosystem and wildlife. High severity fire can scorch soils, removing valuable organic carbon on the surface and in the soil profile, reducing its water holding capacity. When this occurs on slopes, the fire-sterilized soil is more likely to be carried down-slope, causing erosion and reversing hundreds to thousands of years of natural soil building processes. Wildlife habitat is also impacted by high severity fire as ecosystems shift from cool, canopy covered refugia to hot, exposed, and eroded barrens. Some wildlife can exploit these newly disturbed areas and brush lands, while others may need to migrate elsewhere to survive. Newly disturbed sites are also prone to invasion by non-native plant species that grow quickly and take advantage of recently released nutrients and bare, mineral soil. Additionally, some treeless patches are so severely sterilized that new sources of seeds do not exist and the area must be replanted, incurring greater costs and raising uncertainty about success in a continuing drought.

Rural Economies: The absence of forest management creates devastating economic hardship and danger for those living and working in California's rural communities. These megafires often result in millions of dollars worth of infrastructure damage and devastation to the landscape that require lengthy rehabilitation periods. Rural communities also rely on healthy forests for revenues generated from the multiple uses our National forests provide including, but not limited to, timber harvest, grazing, tourism, and recreation.

OPPORTUNITIES

Unfortunately, fuels reduction projects in overgrown forests continue to face numerous obstacles. Despite partnerships between stakeholders and federal, state and local governments, and science that clearly demonstrates the benefits of fuels reduction projects, the pace and scale of proactive forest management is not nearly keeping up with the increased size and severity of wildfires in our western forests. CAFWA believes there are opportunities to help accelerate forest restoration and is undertaking the following actions:

- Building a diverse, bipartisan, urban-rural coalition in California to advocate for increasing the pace and scale of ecologically-based active management in California's forests and watersheds.
- Communicating the importance of California's healthy forests by emphasizing the multiple values that they provide including, but not limited to, water resources.
- Pursuing increased funding and new funding sources for forest management from federal, state, and private sources.
- Advocating for policy and legislative reforms that will promote ecologically sound forest restoration.

- Advancing monitoring and research to improve the state of scientific knowledge to better direct future land management decisions.

CAFWA encourages Congress to pass federal legislation that addresses the following issues:

Promote Landscape-Scale Collaboration -- Congress should incentivize and reward landscape-scale collaboration with local governments and diverse stakeholders by expediting environmental review for collaboratively-based projects that address insect or disease infestation, reduction of hazardous fuels particularly near communities, forest health restoration, wildlife habitat improvement, or protection of municipal water sources.

Fix “Fire Borrowing” -- The structure of wildfire funding desperately needs to be changed to prevent so-called “fire borrowing” - or the shift of dedicated forest management funds at the U.S. Department of Interior and the U.S. Department of Agriculture, to fund wildfire suppression activities – *in addition to*, addressing the increasing costs of suppression over time, which continues to erode program budgets. Currently, the Wildfire Disaster Funding Act is the only proposal positioned to address the multiple complexities of fire budgeting. Resolution of this issue, whether through the Wildfire Disaster Funding Act or an alternative methodology, is critical to the constituencies CAFWA represents.

Expedite Forest Restoration -- Congress should consider providing additional direction and incentives to the Forest Service to undertake fuels reduction and forest management activities on a landscape scale, where supported by effective collaborations. This could include a combination of (1) financial incentives for landscape-scale forest management, possibly tied to a job-creation program to bolster rural economies and provide more certainty over multiple years, and (2) regulatory incentives. Regulatory incentives may include providing direction to the Forest Service to encourage management of the national forests on a landscape scale, including innovative approaches to complying with the National Environmental Policy Act (NEPA) that would meet the policy’s goals while expediting forest management. This approach might include, for example, increased use of landscape-scale Environmental Impact Statements (EIS) that consider environmental impacts and alternatives at a whole-watershed scale while allowing the Forest Service to implement site-specific projects without additional extensive NEPA review, as long as projects are ecologically sound. This may also significantly decrease per-acre analysis costs and expedite project implementation.

Address Pace of Judicial Process -- CAFWA shares the concern that legal challenges can reduce the pace of forest management necessary to reduce wildfire risk and promote more resilient forest conditions. CAFWA recognizes there are several different approaches being debated on how best to address this concern. The goal should be to expedite collaborative, ecologically-based landscape-scale management--while still ensuring that agencies are held accountable and projects are ecologically sound. Congress should work on a solution that advances this goal.

Funding for Forest-Water Research and Demonstration Projects -- Congress should build upon the link between healthy forests, watersheds, and downstream water quality and quantity by funding landscape-scale research and demonstration projects. The goal of such research should be to document and quantify the extent to which landscape-scale forest management serves to safeguard water supply by reducing the risk of high-severity wildfires and resulting erosion and sedimentation, by increasing water yield, and in other respects.

CONCLUSIONS

Accelerating forest restoration and hazardous fuels reduction is essential to securing multiple benefits from our National Forests. These benefits include wildlife habitat, clean water supplies, recreation, forest products, carbon sequestration and healthy rural economies.

Inaction on forest health is contributing to catastrophic megafires. CAFWA encourages Congress and the U.S. Forest Service to quickly address the known budgetary and other obstacles that are contributing to this crisis.

If you would like to reach a member of CAFWA for further details on our position, please contact Erin Huston of the Farm Bureau at ehuston@cfbf.com, Dave Reynolds representing ACWA at direyns@sso.org, Thane Young representing RCRC at tyoung@vsadc.com, David Edelson at dedelson@tnc.org, or Steve Brink with CalForests at steveb@calforests.org.



www.corpsnetwork.org

November 10, 2015

The Honorable Lisa Murkowski
Chairwoman
Senate Committee on Energy &
Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

The Honorable Maria Cantwell
Ranking Member
Senate Committee on Energy &
Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

Dear Chairwoman Murkowski and Ranking Member Cantwell;

On behalf of The Corps Network's Service and Conservation Corps (Corps) across the country, we write to respectfully request your support for the Wildfire Disaster Funding Act, H.R. 167 and S. 235. This important legislation will reform how wildfire suppression is funded in order to significantly minimize the harmful practice of transferring funds from critical programs to pay for wildfire suppression. The Wildfire Disaster Funding Act would fund response to the most disastrous wildfires similar to how the Federal Emergency Management Agency (FEMA) funds other disaster response under the Balanced Budget and Emergency Deficit Control Act of 1985. Instead of competing with funding for response to other natural disasters such as floods, tornadoes, and hurricanes, wildfire disasters would have their own relief mechanism.

The Corps Network's 100+ Corps are diverse in mission and membership and strive to improve quality of life for our participants and in our communities. From building trails and campgrounds on our nation's iconic public lands, to responding to natural disasters and wildfire remediation and fighting, Corps provide communities with valuable services, improve lives, and the environment. Increasing disasters such as fires, risk the lives of Corpsmembers as well as interrupt other recreation, maintenance, and economic development activities on public lands.

Wildfire seasons are getting longer and major wildfires are becoming increasingly more costly to suppress. This national problem is causing a crippling burden on the Department of the Interior and the USDA Forest Service's land management functions as they shift resources to fund suppression activities. Federal wildfire suppression will always be fully funded by the government – even if it comes at the expense of programs that improve forest health and mitigate future wildfires. However, this current ad hoc process of funding wildfire is inefficient and ineffective in delivering on nationwide agency land management priorities set by Congress and virtually assures that overall federal outlays will increase.

We believe a solution to fire funding should: 1) allow access to disaster funding; 2) minimize impacts from transfers; and 3) address the increasing costs of suppression over time. The WDFA, (S. 235, H.R. 167) is a bipartisan proposal that addresses these three items. We encourage you to incorporate WDFA language in the FY2016 appropriations or other related legislative vehicles moving through Congress to ensure this serious budgetary issue is addressed this year.

Additionally, since the Land Water Conservation Fund (LWCF) was not reauthorized in the most recent Continuing Resolution and the fund continues to be used to pay for wildfire suppression, it is also

1275 K Street, NW, Suite 1050, Washington, DC 20005 p: 202.737.6272 f: 202.737.6277



www.corpsnetwork.org

important that take action be taken to fully fund and reauthorize LWCF. Without LWCF, access to our public lands is diminished and proactive forest management provided through LWCF's Forest Legacy Program is reduced. We cannot afford for conservation programs like LWCF to bear the burden of wildfire suppression and fighting and need LWCF to be fully funded to help address the many conservation and recreation needs that exist.

We again respectfully urge your support for Wildfire Disaster Funding Act (WDFA) language in the FY16 appropriations omnibus or passage through other must-pass legislative vehicles. The WDFA is a critical, important step to ensure the long-term sustainability of our nation's forests and other public lands and our Corps stand ready to continue helping manage and improve our nation's important natural resources and great outdoors.

Sincerely,

Mary Ellen Sprenkel

Mary Ellen Sprenkel
CEO

CORPS OF THE CORPS NETWORK

ALASKA

Anchorage Park Foundation (Youth Employment in Parks)
Student Conservation Association (Anchorage Regional Office)

ARIZONA

ACE (American Conservation Experience) (Flagstaff)
Arizona Conservation Corps (Flagstaff & Tucson)

CALIFORNIA

ACE (American Conservation Experience) (Santa Cruz)
California Conservation Corps
Civ Corps
Conservation Corps of Long Beach
Conservation Corps North Bay
Desert Restoration Corps (SCA)
Fresno EOC Local Conservation Corps
Kern Service and Conservation Corps
Los Angeles Conservation Corps
Orange County Conservation Corps
Sacramento Regional Conservation Corps
San Francisco Conservation Corps

San Gabriel Valley Conservation Corps
San Joaquin Regional Conservation Corps
San Jose Conservation Corps & Charter School
Sequoia Community Corps
Student Conservation Association (Oakland Regional Office, Western Region Headquarters)
Urban Conservation Corps (Southern California Mountains Foundation)
Urban Corps of San Diego County

COLORADO

Conservation Legacy
Larimer County Conservation Corps
Mile High Youth Corps (Denver and Colorado Springs)
Rocky Mountain Youth Corps (Steamboat Springs)
Southwest Conservation Corps (Four Corners/Durango & Los Valles/Salida)
Western Colorado Conservation Corps

CONNECTICUT

Knox Parks Foundation - Green Crew

DISTRICT OF COLUMBIA



www.corpsnetwork.org

Student Conservation Association (Capital Region Office)

FLORIDA

Community Training Works, Inc. Young American Conservation Corps
Greater Miami Service Corps

GEORGIA

Greening Youth Foundation

HAWAII

KUPU - Hawaii Youth Conservation Corps

IDAHO

SCA Idaho AmeriCorps

ILLINOIS

Student Conservation Association (Chicago Regional office, Central Region headquarters)
YouthBuild Lake County
Youth Conservation Corps, Inc.

IOWA

Conservation Corps Minnesota & Iowa

LOUISIANA

Limitless Vistas, Inc.

MAINE

Maine Conservation Corps

MARYLAND

Civic Works
Montgomery County Conservation Corps (a program of Latin American Youth Center)

MASSACHUSETTS

Massachusetts Corps (SCA)

MICHIGAN

Michigan Civilian Conservation Corps
SEEDS
Student Conservation Association (Detroit Regional Office)

MINNESOTA

Conservation Corps Minnesota & Iowa

MISSISSIPPI

Climb CDC Conservation Corps

MISSOURI

AmeriCorps St. Louis

MONTANA

Montana Conservation Corps

NEVADA

Nevada Conservation Corps (a program of the Great Basin Institute)

NEW HAMPSHIRE

New Hampshire Corps (SCA)

NEW JERSEY

New Jersey Youth Corps of Atlantic Cape May
New Jersey Youth Corps of Camden County / The Work Group
New Jersey Youth Corps of Elizabeth
New Jersey Youth Corps of Jersey City
New Jersey Youth Corps of Middlesex County
New Jersey Youth Corps of Monmouth County / Interfaith Neighbors, Inc.
New Jersey Youth Corps of Newark / International Youth Organization
New Jersey Youth Corps of Paterson
New Jersey Youth Corps of Phillipsburg
New Jersey Youth Corps of Trenton
New Jersey Youth Corps of Vineland
Student Conservation Association (New Jersey Regional office)

NEW MEXICO

Rocky Mountain Youth Corps
Santa Fe YouthWorks
Southwest Conservation Corps Ancestral Lands (Pueblo of Acoma & Shiprock)

NEW YORK

Adirondack Corps (SCA)
Excelsior Conservation Corps
Green City Force
Hudson Valley Corps (SCA)
Bronx Justice Corps
Harlem Justice Corps
Brooklyn NY Justice Corps
Queens Justice Corps



www.corpsnetwork.org

New York Restoration Project
Headwaters Youth Conservation Corps (a program of The Place)
Onondaga Earth Corps
The Service Collaborative of Western New York
Student Conservation Association (New York City)

NORTH CAROLINA

ACE (American Conservation Experience)
Northwest Piedmont Service Corps

OHIO

WSOS Community Action

OREGON

Heart of Oregon Corps
Northwest Youth Corps

PENNSYLVANIA

PowerCorps PHL
Student Conservation Association
(Philadelphia/Camden Regional office)
Student Conservation Association (Pittsburgh Regional office)

SOUTH CAROLINA

The Sustainability Institute Energy Conservation Corps

TENNESSEE

CAC AmeriCorps
Southeast Youth Corps

TEXAS

American YouthWorks Texas Conservation Corps
Student Conservation Association (Houston Regional Office)

UTAH

ACE (American Conservation Experience) (Salt Lake City & St. George)
Canyon Country Youth Corps
Utah Conservation Corps

VERMONT

Green Mountain Club
Vermont Youth Conservation Corps

VIRGINIA

Student Conservation Association (HQ)

WASHINGTON

EarthCorps
Mt. Adams Institute
Student Conservation Association (Seattle Regional Office)
Washington Conservation Corps

WEST VIRGINIA

Citizens Conservation Corps of West Virginia

WISCONSIN

ADVOCAP (Fresh Start program)
Great Lakes Community Conservation Corps
Milwaukee Community Service Corps
Operation Fresh Start
Renewal Unlimited, Inc. (Fresh Start program)
Student Conservation Association (Milwaukee Regional office)
WisCorps - Wisconsin Conservation Corps

WYOMING

Wyoming Conservation Corps

CC: The Honorable Tom Vilsack, Secretary, US Department of Agriculture
The Honorable Sally Jewell, Secretary, US Department of the Interior
The Honorable Robert Bonnie, Under Secretary of Natural Resources and Environment, US Department of Agriculture
The Honorable Tom Tidwell, Chief, U.S. Forest Service
Christy Goldfuss, Managing Director, White House Council on Environmental Quality