

**THE 2018 WILDLAND FIRE OUTLOOK AND THE
WILDLAND FIRE MANAGEMENT PROGRAMS**

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

—————
JUNE 5, 2018
—————



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

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

—————
U.S. GOVERNMENT PUBLISHING OFFICE

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	JOE MANCHIN III, West Virginia
CORY GARDNER, Colorado	MARTIN HEINRICH, New Mexico
LAMAR ALEXANDER, Tennessee	MAZIE K. HIRONO, Hawaii
JOHN HOEVEN, North Dakota	ANGUS S. KING, JR., Maine
BILL CASSIDY, Louisiana	TAMMY DUCKWORTH, Illinois
ROB PORTMAN, Ohio	CATHERINE CORTEZ MASTO, Nevada
SHELLEY MOORE CAPITO, West Virginia	TINA SMITH, Minnesota

BRIAN HUGHES, *Staff Director*

PATRICK J. McCORMICK III, *Chief Counsel*

LUCY MURFIT, *Senior Counsel and Public Lands & Natural Resources Policy Director*

ANNIE HOEFLER, *Professional Staff Member*

MARY LOUISE WAGNER, *Democratic Staff Director*

SAM E. FOWLER, *Democratic Chief Counsel*

BRYAN PETTIT, *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

Christiansen, Victoria, Interim Chief, U.S. Forest Service, U.S. Department of Agriculture	19
Rupert, Jeffery, Director, Office of Wildland Fire, U.S. Department of the Interior	24

ALPHABETICAL LISTING AND APPENDIX MATERIAL SUBMITTED

Cantwell, Hon. Maria:	
Opening Statement	3
Map produced by Predictive Services, National Interagency Fire Center, dated June 1, 2018 entitled "Significant Wildland Fire Potential Outlook August 2018"	4
Article by Jonathan W. Long, Leland W. Tarnay, and Malcolm P. North in the Journal of Forestry in January 2018 entitled "Aligning Smoke Management with Ecological and Public Health Goals"	7
Chart entitled "Large Air Tanker Fleet Size on USFS Exclusive Use Contracts"	36
Center for Biological Diversity, et al.:	
Letter for the Record	69
Christiansen, Victoria:	
Opening Statement	19
Written Testimony	21
Responses to Questions for the Record	52
CoreLogic:	
Letter for the Record	71
Murkowski, Hon. Lisa:	
Opening Statement	1
National Association of State Foresters:	
Letter for the Record	72
Rupert, Jeffery:	
Opening Statement	24
Written Testimony	26
Responses to Questions for the Record	64

THE 2018 WILDLAND FIRE OUTLOOK AND THE WILDLAND FIRE MANAGEMENT PROGRAMS

TUESDAY, JUNE 5, 2018

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

The Committee met, pursuant to notice, at 10:08 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. Good morning, everyone. The Committee will come to order.

It is nice to be able to welcome you back to the Committee, Ms. Christiansen. Mr. Rupert, welcome to you.

We are here this morning to discuss the outlook for the 2018 wildfire season. Just based on what we already know to date, it does not look good. Last Friday, the National Interagency Fire Center, which is a joint operation between the Department of the Interior and the U.S. Forest Service, released its monthly wildland fire potential outlook for June through September. Warmer and drier than average conditions are anticipated, and the Southwest, in particular, is at very high risk for wildfires due to elevated drought conditions and strong winds. I feel like a weather reporter here.

The Tinder Fire, sparked on April 27th in central Arizona, marked the first large-scale wildfire of the season in the West. There are now several significant, active fires, including massive blazes in Colorado and New Mexico that are already forcing evacuations. Already this year, almost 24,000 wildfires have burned about 1.7 million acres across the country and this is just June the 5th.

The number of wildfires and acres that ultimately burn in 2018 depends not only on wildfire potential and forest conditions but on the timing of lightning strikes and human-caused ignitions.

Nationwide, people are responsible for starting 84 percent of the wildfires. And by starting so many fires, many through human carelessness, people are essentially lengthening the fire season into the early spring and late fall, times of the year when lightning just does not have a major role. The Eagle Creek Fire that raged through the Columbia River Gorge in Oregon in 2017 started by a

teenager that was messing around with firecrackers, just one of many examples.

With the 2018 fire season upon us, I want to start with a plea to people everywhere, just please be smart about fire. We can make a measurable difference in what this wildfire season ends up looking like, and it starts with being careful.

It is also time to execute a multipronged federal-state-local strategy to meet the increasing challenges presented by wildland fire in a cost-efficient manner. First is innovation. Our committee discusses innovation at length on the energy side of the policy shop, but we also have significant opportunities with respect to land and wildfire management. Last fall, we held an entire hearing on wildfire technology.

I am particularly interested in the use of unmanned aircraft systems, or drones, which are playing a greater role in wildfire management response from detecting, mapping and even helping to contain wildfires. It is far cheaper to operate, maintain, and train personnel on drones, and it also helps reduce risks for pilots, crews, and firefighters.

The Department of the Interior and the State of Alaska have been early adopters in the use of drones, and not just for wildfire. Interior is using its drones across its management functions, including to monitor the ongoing volcanic eruption in Hawaii.

We can and should do more to embrace technology in land management, including in wildfire management. I know Senator Cantwell is very interested in this as well, so hopefully this will be an area where we will be able to make bipartisan progress.

After that, we need to look for opportunities to increase efficiencies in wildland fire operations at the federal level. The Forest Service and the Department of the Interior have long coordinated aspects of their suppression programs through the National Interagency Fire Center but collaboration can still improve with respect to procurement, budgeting, information technology, and human capital.

One program to focus on, of course, is aviation services. I still do not fully understand why the Forest Service and Interior have their own separate programs.

I have also said, over and over, that wildfire is not just a budget problem, it is a management problem—meaning that we must actively manage our forests. In Alaska, we have seen the benefits of upfront investments in hazardous fuel reduction and fire breaks before fires start.

Back in 2014, a large, strategically placed fuel break between the Kenai National Refuge and Soldotna saved homes and lives during the massive Funny River Fire. Then in 2015, hazardous fuel reduction treatments conducted a few years earlier around Sterling reduced the wildfire risk to that community during the Card Street Fire.

In the FY'18 Omnibus, Congress provided significant funding to address wildfires. We also provided some new authorities, not necessarily at the level that I believe are necessary, but what we could characterize as a start. The agencies wanted those authorities, so we certainly expect them to put them to good use. So, no excuses there.

I want to end by saying that to effectively fight fires and manage the lands, you must rid your agencies of sexual harassment, bullying, and retaliation. Workplace misconduct cannot be tolerated, especially on the fire lines in the field. Focus on the mission and be professional about it or be ready to face the consequences.

With that, again I would like to welcome the Interim Chief of the Forest Service, Vicki Christiansen, and the Director of the Office of Wildland Fire at the Department of the Interior, Jeff Rupert, to the Committee.

I thank you both for being with us today. I look forward to our discussion this morning as we work to reduce wildfires across the country.

Senator Cantwell.

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

Senator CANTWELL. Thank you, Madam Chair, and thank you for that very strong statement. I wholeheartedly agree with you on the issue of sexual harassment and what the agency needs to do to better manage and train and skill people in response to these issues. I also appreciate your very strong statement about drones. As we approach this fire season, making sure those on the fire line have the best possible information is going to be critical, on weather conditions, on information about fire movement, on all of that.

I recently attended a breakfast where the Secretary of Agriculture was entering into an MOU with the Secretary of the Interior to work together on many things, including the advancement of the use of drones for firefighting.

The Department of the Interior has done unbelievable work on our federal drone fleet. I don't want the Department of Agriculture to waste one minute recreating something when it could just share in the same implementation for what the Department of the Interior has done. So I hope that the Department of Agriculture will work on that.

I wanted to get started talking about the release over the weekend from the National Interagency Fire Center (NIFC). For years now, the Committee has heard over and over that our wildfires are getting worse, and climate scientists have been telling us the fire season is getting longer and hotter. Now this new NIFC forecast will have the Pacific Northwest in July/August on the side of what we have seen in the past few years in terms of a fire season.

[The information referred to follows:]



Senator CANTWELL. Most of the West received less than 50 percent of its average precipitation for May which will likely result in fuels in the mountains becoming critically dry by late July. My colleague, Senator Wyden, and I were just discussing this as it relates to what that means for us anytime there is less precipitation: just a drier environment in which we all have to be very, very mindful of.

Nearly all of the country experienced temperatures that were two to six degrees above average last month. Central Washington temperatures were ten degrees above average. Because these conditions are supposed to last through September, places like Southeast Washington will likely experience more large fires than they have in previous years, starting in July.

I know that we have a couple of fires already started in our state. Hopefully people will be working very quickly to put those out, but it's just a very early reminder of how challenging this season could be.

Areas in Washington, in Oregon, and in Idaho—I know my colleague from Idaho is trying to be here... East of the Cascade Crest, will likely experience more large fires than we have seen in the last few years, starting in August.

Given what we are looking at this summer, I want to make sure that we are ensuring firefighters have every tool available to them to help fight these fires. They need to be as safe as possible and as efficient as possible.

Everyone here has heard me talk about the Carlton Complex fire we had in Washington a few years ago where 149,000 acres burned up, literally, in a single day. The following year, the fires in Washington were even worse, and we witnessed first-hand the disaster on what the aftermath means for people living in these communities. Our heroic men and women firefighters did everything they could to be ready, and we need to do everything we can to be ready for this upcoming fire season.

Fires are becoming more lethal. In the speech that Chief Christiansen gave during last week's International Association of Wildland Fire Conference, she mentioned, which really struck me, that since 1910, we have had more than 1,000 deaths from wildland fires. But the more sobering fact is that more than a quarter of those, 255, have occurred in the last 15 years. We can see that they are literally becoming more lethal.

When we get to questions, I am definitely going to ask about our efforts on firefighter and safety modernization. We want to make sure that every tool is there for our wildland firefighters, as I said, with real-time information. We also want to make sure that our fire shelters are modernized—developed and implemented in a way that the safety of wildland firefighters are improved.

We had a very unfortunate death in the Thirtymile Fire in which the firefighter's shelter wasn't really successfully deployed, and we bore the tragic loss of life in the Pacific Northwest.

As you now deploy new shelters and use temporary wildland firefighters with fewer hours of training compared to our permanent firefighting force, we want to make sure that everybody is trained and also that there is not an expectation of being someplace that they shouldn't be. So we want to work with you on that.

We also want to have more hasty response to wildfires. Firefighters need to be able to use those technologies that give them the most efficient resource. We also want to be very strategic about protecting these communities that are in the wildland-urban interface.

In March, Congress took an important step by addressing part of the wildfire problem, and members of this Committee worked very hard on a Title of the Omnibus bill dedicated to wildfire, and many of the other people here in this room worked very hard on that. This law helps the Forest Service have adequate resources to respond to wildfires and do their necessary work. We provided significant funding for firefighting for the next 10 years to get out of the fire-borrowing paradox.

So I hope that there is also enough funding for the non-fire programs that can benefit our communities as well, and we sustain the increase in funding that will help us do fire prevention and fuels treatment in advance of the fire season. That said, our law explicitly prevents the loss of funding from the Forest Service Non-Fire Accounts.

So what was included in that package that we think will make things easier? Obviously, our state agencies like Washington DNR are able to partner better with the Forest Service. We hope the Forest Service takes advantage of that. I think that during the fires two years ago was the first time in decades that the public was called to the line, that's how bad the fire season was. We hope the Good Neighbor projects are implemented. We hope that the vegetation management around power lines is implemented. We hope the 20-year contracts to do thinning and fuel reduction on national forests and promote the development of cross-laminated timber are implemented; and we hope the Forest Service will do all the things it can to reduce fuels in advance of wildfires.

I want to highlight this interesting article that was just published in this month's *Journal of Forestry*. It basically shows that per acres burned on a wildfire, a fire burning in August puts out more than five times as much smoke as a controlled burn in May and June.

[The information referred to follows:]

fire & fuels management

Aligning Smoke Management with Ecological and Public Health Goals

Jonathan W. Long, Leland W. Tarnay, and Malcolm P. North

Past and current forest management affects wildland fire smoke impacts on downwind human populations. However, mismatches between the scale of benefits and risks make it difficult to proactively manage wildland fires to promote both ecological and public health. Building on recent literature and advances in modeling smoke and health effects, we outline a framework to more directly quantify and compare smoke impacts based on emissions, dispersion, and the size and vulnerability of downwind populations across time and space. We apply the framework in a case study to demonstrate how different kinds of fires in California's Central Sierra Nevada have resulted in very different smoke impacts. Our results indicate that the 257,314-acre Rim Fire of 2013 probably resulted in 7 million person-days of smoke impact across California and Nevada, which was greater than 5 times the impact per burned unit area than two earlier wildfires, Grouse and Harden of 2009, that were intentionally managed for resource objectives within the same airshed. The framework and results suggest strategies and tactics for undertaking larger-scale burns that can minimize smoke impacts, restore forest ecosystems, and reduce the potential for more hazardous wildfire and smoke events.

Keywords: air quality, California, USA, particulate matter, socioecological systems, wildland fire

Wider use of ecologically beneficial fire has been suggested as a critical tool for increasing the pace and scale of forest restoration and for avoiding extreme wildfires that pose threats to human health (North et al. 2015, Schweizer and Cisneros 2016). A range of constraints, however, have hindered the use of fire to meet resource objectives, whether through prescribed burning or managing wildfires for resource objectives (hereafter called "resource objective wildfires"). Air quality policy and regulations have been particularly significant constraints on intentional use of fire (Carroll et al. 2007, Quinn-Davidson and Varner 2012, Engel 2013).

Tensions reflect long-standing division of responsibilities between forest managers concerned with restoring forests and air regulators concerned with protecting public health (Sneeuwjagt et al. 2013). A recent update to wildfire-smoke policy proposed by the US Environmental Protection Agency (US EPA) recognized the need to restore and maintain more frequent fire regimes through intentional use of fire, while asserting that protecting human health remained the agency's "highest priority" (Office of the Federal Register 2015). Therefore, addressing both forest restoration and air quality objectives remains a central challenge.

This article explores strategies that for-

est managers and air quality regulators can jointly pursue to minimize public health impacts while restoring more natural fire regimes. First, we consider factors that make this challenge so difficult, by examining how the social and ecological context of fire involves scale mismatches that create disincentives for ecologically beneficial use of wildland fire. Second, we outline a more direct framework for quantifying smoke impacts to human populations through monitoring and analysis of daily emissions, the location and density of resulting smoke plumes, and the size and vulnerability of populations within such plumes. We show how the framework can link tools that forest managers, air regulators, and public health experts are already using, but that are often not systematically applied to resource objective wildfires and prescribed fires. Through a case study, we examine how smoke impacts from intentional use of fire are likely to differ from an extreme wildfire targeted for suppression. We focus on the area affected by the Rim Fire, which escaped from a campfire on Aug. 17, 2013, to become the largest fire in the history of the Sierra Nevada. Because this area also had a recent history of prescribed burns and resource objective wildfires, it afforded a distinctive opportunity to consider how working with fire can influ-

Received August 10, 2016; accepted December 12, 2016; published online January 19, 2017.

Affiliations: Jonathan W. Long (jwlong@fs.fed.us), USDA Forest Service Pacific Northwest Research Station, Davis, CA; Leland W. Tarnay (ltarnay@fs.fed.us), USDA Forest Service Region 5; Malcolm P. North (mnorth@fs.fed.us), USDA Forest Service Pacific Southwest Research Station.

Acknowledgments: This article was informed by data and experience by one of the authors as an Air Resource Specialist for Yosemite National Park, as well as support from the Park's fire management and resource management staff. We thank T. Procter, H. Preisler, L. Heath, and A. Bytnerowicz for thoughtful reviews and insights that contributed to this article. The USDA Forest Service Pacific Southwest Research Station and Region 5 Air Quality Program provided support for this research.

ence smoke impacts. Finally, we discuss how this quantitative framework can help managers and regulators implement proactive fire management strategies that align public health and forest restoration objectives. We highlight examples from California's Sierra Nevada, but many of these challenges are common to other parts of the world where increasingly large and severe wildfires are impacting large populations (Williams 2013).

Socioecological Context

The last century of fire suppression in California has caused past and current generations to expect less frequent fire and smoke than was integral to seasonally dry forest ecosystems (Stephens et al. 2007). It has also contributed to less frequent, larger, and more severe wildfires (Stephens and Sugihara 2006, Miller and Safford 2012, Fulé et al. 2014). These extreme fires not only directly threaten lives and property but they also produce enormous quantities of smoke that pose significant health risks, especially when affecting large urban areas (Strand et al. 2012, Mochter et al. 2013, Schweizer and Cisneros 2016). Important health risks include increased mortality and respiratory morbidities associated with fine particulate matter (less than 2.5 microns, known as $PM_{2.5}$) (Liu et al. 2015). Wildfires are an unpredictable component of $PM_{2.5}$ pollution in California, contributing only 17,068 tons in 2005, 529,821 tons in 2008, and 53,487 tons in 2011. The wildfire emissions in 2008 represented 68% of all $PM_{2.5}$ emissions in the state, and they caused notable public health impacts (Wegesser et al. 2009, Preisler et al. 2015). Such impacts are likely to worsen in the future, because higher temperatures and accumulated fuels are expected to favor very large fires in fire-prone regions such as California (Barbero et al. 2015). Hurteau et al. (2014) found that under a business-as-usual climate scenario, this escalation in fire potential is likely to increase wildfire emissions in California by 50% by the end of this century unless agencies take a more proactive approach to fire use.

An important spatial mismatch results from the fact that large wildfires can create smoke impacts on distant urban populations. The risk to urban populations from regional-scale smoke impacts has increased as California became the most urbanized state in the United States, with 90% of its population residing within cities that have

Sidebar 1. Glossary of Technical Terminology

Air resource advisors—Personnel with specialized training who are assigned to coordinate air quality monitoring and smoke concentration and dispersion modeling on wildland fires.

Hazard mapping system (HMS) smoke product—A map produced by the National Oceanic and Atmospheric Administration that indicates the location and density of significant smoke plumes.

Prescribed fire—A wildland fire originating from a planned ignition that is intentionally managed to achieve resource objectives.

Push/pull fire tactics—Tactics for speeding or slowing fire spread, which can be used to influence the rate of smoke production.

Resource objective wildfire—A wildland fire originating from an unplanned ignition that is intentionally managed to achieve resource objectives such as reducing fire danger or forest restoration rather than being targeted for suppression. Such fires have also been labeled "resource benefit wildfire," "wildland fire use," or "managed wildfire" (see Hunter et al. 2014).

Wildland fire—Any nonstructure fire that occurs in vegetation or natural fuels.

Suppression wildfire—An unplanned wildland fire where the objective is to put the fire out.

more than 50,000 people and another 5% living in smaller urban clusters (US Census Bureau 2015). Many of those urban areas are situated in valleys or basins that have poor air quality due to human activities as well as natural conditions that often trap pollutants (Ngo et al. 2010, Nakayama Wong et al. 2011). For example, the four metropolitan areas in the United States with the highest levels of particle pollution are all located in California's Central Valley (American Lung Association 2015). Because many urban populations already experience poor air quality during the summer, they are particularly vulnerable to health impacts from wildfires (Delfino et al. 2009, Cisneros et al. 2014).

An important temporal mismatch re-

sults from the ability of present generations to pass accumulated fuels that result from fire suppression onto future generations (North et al. 2012, Lueck and Yoder 2015). In the shorter term, current policies have permitted regulators to curtail fires intentionally managed for resource objectives in response to nuisance complaints by a few individuals, despite the potential for such fires to have long-term collective benefits (Engel 2013). Because the impact and likelihood of smoke increase the longer that fire is kept out of the system, extensive fire suppression can result in a vicious cycle that becomes more and more costly to escape until the system fails, as represented by extreme wildfires (Calkin et al. 2015). Many members of the public agree with researchers and

Management and Policy Implications

Forest managers and air quality regulators could better align the dual objectives of restoring forests and protecting human health by using a common framework to quantitatively manage and evaluate the smoke impacts of different kinds of fires on downwind populations. Some smoke management policies discourage managing large fires for resource objectives and risk shunting inevitable emissions into even larger and long-lasting wildfires that expose sizeable human populations to unhealthy concentrations of particulate matter. Managing wildland fires under favorable conditions can help to restore forests, reduce hazardous fuels, and mitigate potentially harmful smoke impacts on downwind populations by decreasing daily emissions and taking advantage of favorable dispersion. Our framework supports smoke management strategies including the following: incentivizing reduction of human exposure to hazardous smoke levels over space and time rather than area burned; pacing fire spread based on airshed capacity to disperse the resulting emissions; and communicating with the public to reduce the exposure of downwind populations and the benefits of managing wildland fires for resource objectives. Advancing these strategies will depend on coordinated efforts by forest and fire managers, air quality regulators, and air resource advisors with specialized skills in evaluating and communicating fire impacts on downwind populations.

**Smoke Impact = f (Emissions \times Dispersion \times Population Vulnerability)
integrated over time and space**

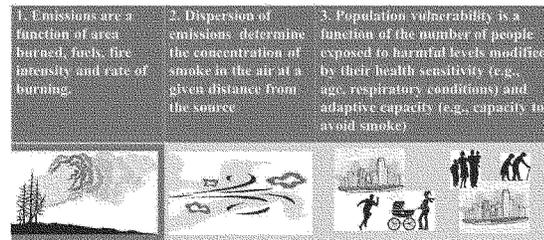


Figure 1. Framework for evaluating smoke impacts using source emissions, dispersal and downwind populations, integrated over time and large areas of fire influence.

managers who have argued that tolerating short-term impacts of prescribed fires may avoid more harmful impacts (Olsen et al. 2014). However, those arguments have not been well aligned with regulatory systems designed to protect public health, visibility, and safety, which vary across and within states (Engel 2013).

Within California, decisions regarding particular fires are generally made on a case-by-case basis by local air districts. These decisions often rely on area burned as a proxy for reporting and evaluating potential smoke impacts from fires and for setting thresholds for providing additional documentation for permits (California Air Resources Board 2015). For example, local regulators have sometimes limited burns to less than 50 acres per day when air quality conditions were considered marginal for dispersing smoke (Carolyn Ballard, Fire Management Officer, Sierra National Forest, pers. comm., April 19, 2016). Because suitable burn windows are often limited to only a few consecutive days, such constraints can make it infeasible to burn the hundreds or thousands of acres needed for landscape restoration. In addition, some air pollution control districts in California have imposed fees for each unit of area burned for prescribed fires and resource objective wildfires, although not for wildfires targeted for suppression (Sneeuw-jagt et al. 2013). These fees are used to offset the costs of reviewing smoke plans and monitoring air quality during burns; however, they also provide a disincentive for wildland fires that are managed for resource benefits. For reasons we discuss throughout the article, shifting from an emphasis on area

burned toward more direct measures of smoke impact may afford opportunities to better align public health and ecological restoration.

Measuring Smoke Impacts on Public Health

Smoke and wildfires can impact public health in ways other than particulate pollution, including ozone pollution, increased stress during and after wildfires, and strains on medical services and communication systems (Fowler 2003, Kumagai et al. 2004, Finlay et al. 2012). Despite these broader considerations, public health regulations for smoke typically focus on a 24-hour average of $PM_{2.5}$. Values that exceed $35 \mu g/m^3$ are considered unhealthy for sensitive groups, which include pregnant women, young children, elderly individuals, smokers, and people with chronic respiratory problems such as asthma (Delfino et al. 2009, Kochi et al. 2010, Moeltner et al. 2013). Although this standard is an important quantitative threshold, higher levels of $PM_{2.5}$ are associated with broader and greater health risks, so incorporating concentration-response relationships will improve estimates of smoke impact. Furthermore, exceedances of the 24-hour standard may not signify an actual health impact on a particular day, as forecasting of smoke can help people take steps to reduce their exposure (Rappold et al. 2014). A broad accounting of smoke impacts also should consider other demographic and institutional factors that influence vulnerability and adaptive capacity (Cross 2001, Trainor et al. 2009).

One approach for estimating the smoke impact in economic terms has been to multiply the number of person-days of impact by individuals' willingness to pay to avoid exposure. For example, Richardson et al. (2012) found that individuals in several southern California cities were willing to pay \$84.42 (in 2012 dollars) to avoid a day of wildfire smoke impact resulting from the Station Fire of 2009, during which ground-level conditions exceeded the 24-hour standard for 1–3 days. Jones et al. (2016) found a per capita willingness to pay of \$130 (in 2014 dollars) to avoid wildfire smoke health effects in Albuquerque during the Wallow Fire of 2011.

A Quantitative Framework for Evaluating Smoke Impacts

We outline a quantitative framework (Figure 1) to evaluate smoke impacts that can be applied using existing tools and data sets to improve understanding of potential smoke impacts across large areas over time. Some fire managers routinely conduct the first two steps, quantifying source emissions and downwind concentrations, but they have traditionally compiled summaries over the total size and duration of the burn, rather than tracking the daily variation of emissions relative to dispersion. For both prospective planning and retrospective evaluation of fire outcomes, it is important to quantitatively account for the smoke impacts to public health in space and time.

Source emissions can be estimated based on fuel loads using tools such as the First Order Fire Effects Model (FOFEM) (Lutes 2014) or the BlueSky Playground.¹ Emissions from fires may vary by an order of magnitude, depending on the type of vegetation, the fuel loading associated with that vegetation type (Leenhouts 1998), and the intensity and the severity of the fire activity. For example, a forest where fuels have accumulated unchecked for decades will have much heavier fuel loads and expected emissions than otherwise similar areas subjected to frequent fires. Consequently, area burned, while easy to measure, may not correlate well with smoke production.

The second step in the framework is to evaluate population exposure to pollutants within observed or modeled smoke plumes. Because standards to protect public health are often based on 24-hour average $PM_{2.5}$ values and available dispersion varies substantially from day to day, daily emissions

are particularly important for evaluating smoke impacts. The National Oceanic and Atmospheric Administration (NOAA) began providing maps of smoke plume density based on satellite observations through their Hazard Mapping System (HMS) in November 2006 (Ruminski et al. 2007). Predictions of surface $PM_{2.5}$ levels are limited by difficulty in determining how much smoke has reached the surface, but these data provide an objective means of defining a potential area of influence for a particular fire.

Our framework can also be applied prospectively to fires by using BlueSky, HYSPLIT,⁵ CALPUFF,⁶ or other modeling tools to spatially and temporally forecast smoke concentrations downstream from fires using daily emission and dispersion estimates (Goodrick et al. 2013). Research has supported this approach, as Fusina et al. (2007) found that plume trajectories generated in BlueSky agree well with satellite observations and ground-level $PM_{2.5}$ concentrations. Furthermore, Yao et al. (2013) found significant associations between BlueSky-forecasted and HMS smoke plumes and respiratory health outcomes such as asthma-related physician visits.

The third step in the framework is to quantify the size and vulnerability of the affected populations within the areas of smoke influence for the duration of the fire. One approach is to use census data to estimate populations underlying mapped smoke plumes weighted by smoke density and the expected likelihood and intensity of impact. Finer analyses of such data can consider demographic variables that often indicate vulnerability, such as age, income, race, education, and health, although fine-scale data on the incidence of respiratory disease are usually lacking (Gaither et al. 2015).

The framework can be extended to include monetary metrics by multiplying the estimates of person-days of exposure by estimated health costs or other valuations. The US EPA has developed a tool, BenMAP-CE,⁶ for estimating economic impacts of air pollution based on population data, modeled or monitored air quality data, concentration-response functions, and valuation measures (Jones et al. 2016). Another extension of the framework would be to iteratively model regional airshed conditions to project the benefits of using fire at large scales over long periods. Such efforts would be com-

plex, but they would help decisionmakers and the public evaluate potential tradeoffs.

Method for Applying the Framework to Selected Fires

We applied the framework retrospectively to compare differences in smoke impacts between resource objective wildfires and full-suppression wildfires within the San Joaquin River watershed in California's Sierra Nevada, the Sierras that burned between 2002 and 2013, including 10 resource objective wildfires (totaling 20,494 acres), 17 prescribed fires (totaling 6,636 acres), 4 small wildfires (totaling 12,025 acres), and the exceptionally large Rim Fire (257,314 acres). This comparison requires several caveats: (1) the use of resource objective wildfires has varied historically, reflecting continuing evolution in policy and practice; (2) some resource objective fires are categorized as suppression wildfires when they no longer meet desired objectives; (3) the Rim Fire burned through and into several of the previous fires; and (4) the limited availability of smoke monitoring data, particularly before 2007, requires a focus on modeled emissions.

We evaluated the smoke impacts of two relatively large resource objective wildfires: the Grouse Fire (3,042 acres) and the Harden Fire (1,653 acres), which were ignited by lightning on May 31, 2009, and June 8, 2009, respectively, and then allowed to burn for multiple objectives. The Grouse Fire is significant as the first instance in which fire managers in Yosemite National Park explicitly designed the fire contingency plan to incorporate thresholds for $PM_{2.5}$ monitored at sensitive sites. The same incident team simultaneously managed the Harden Fire for resource objectives within an area bounded by containment lines and rock, while focusing active resources on the Grouse Fire. These two fires illustrate the potential for managing multiple fires to achieve resource objectives for an extended period. Furthermore, when combined, these resource objective fires were the largest in the study area for which the HMS smoke density maps were available.

To estimate emissions in the first step in the framework, we developed maps of daily fire spread for fires of all types in the Tuolumne watershed since 2002 using records of fire progression from the Yosemite fire his-

tory database (Yosemite National Park 2012), operational notes, and smoke management plans for prescribed fires on the Stanislaus National Forest and Yosemite National Park (Kent van Wagtenonk, Taro Pusina, and Mike Beasley, National Park Service, pers. comm., July 19, 2015). In this analysis, we assumed that daily emissions are based only on areas of new fire growth for a given day because there is no established method for allocating emissions across multiple days. We used FOFEM within a geographic information system (GIS) to calculate emissions for each daily fire progression polygon based on inputs of fuel loads and fuel moisture for each vegetation type, following the approach by Clinton et al. (2003). This spatially explicit method accounts for area of the different vegetation types within the polygons for each days spread, for each fire, then incorporating crosswalks assigned from the California Gap Analysis Project (GAP) land cover map (Davis et al. 1998), to estimate total daily emissions from the FOFEM output. Because we lack systematic and detailed fuel plots, we assigned "light" fuel loads for areas that had experienced fires in the previous 12 years, while assigning "typical" loads otherwise (see Supplemental Table S1[†]). Lydersen et al. (2014) found that this approach yielded reasonably accurate consumption estimates when applied to large areas within the Sierra Nevada. We modeled prescribed burns as surface fires but allowed wildfires and resource objective wildfires to burn into tree crowns. We estimated fuel moistures using operational notes from individual fires and representative values from remote automatic weather stations used in Yosemite's fire management program.

For the second step in the framework, we adapted the methodology used by Preisler et al. (2015), who related HMS smoke maps to monitored surface $PM_{2.5}$ values for a range of fires in the Central Sierra Nevada. They determined that plumes of HMS smoke within 6.2 miles of a monitoring site were associated with significant increases in daily average values of $PM_{2.5}$, with a likelihood of 36.5% (95% confidence limit [CL] was 27–47%) of exceeding the "norm" on days with dense smoke and 17% (95% CL was 12–23.5%) on days with medium-density smoke. The norm was the expected level on each day for each site when smoke

[†] Supplementary data are available with this article at <http://dx.doi.org/10.5849/JOF-2016-042R2>.

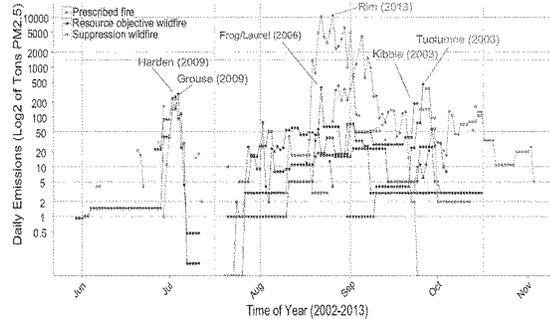


Figure 2. Estimated daily emissions of $PM_{2.5}$, as generated by the FOFEM for different types of fire within the Tuolumne River watershed, California, between 2002 and 2013. Points on each line represent one day of estimated emissions for a specific fire. Note the log base 2 y-axis; see Figures 4A and 4B for the nonlogarithmic version.

plumes were excluded. In particular, they estimated that the daily 96th percentile value of $PM_{2.5}$ increased by $14 \mu g/m^3$ (95% CL was $9-19 \mu g/m^3$) where there was heavy smoke and by $5 \mu g/m^3$ (95% CL was $3.6-6.1 \mu g/m^3$) where there was medium-density smoke. At many of the higher elevation sites, the normal values were far below the $35 \mu g/m^3$, so only heavy smoke plumes were likely to cause an exceedance. However, in some urban sites, the norm during the fire season was already close to the $35 \mu g/m^3$ threshold for “unhealthy for sensitive groups.” In such locations, even the modest $5 \mu g/m^3$ increase due to medium density smoke could cause or worsen exceedances (Cisneros et al. 2014).

We mapped the HMS medium- and high-density smoke plumes that appeared to be connected with the Rim, Grouse, and Harden Fires. In particular, we had to demarcate some of the smoke plumes during the early days of the Rim Fire that overlapped with the American Fire, which was fully contained by Aug. 29, 2013. To represent ground-level impacts over time, we examined the values for particulate matter for the Rim and Grouse Fires at monitoring sites in Yosemite Village in both 2009 and 2013 and in Reno for 2013 (data were not available for 2009) (US EPA 2016).

For the third step of the analysis, we used ArcMap (version 10.1; ESRI, Redlands, CA) to sum the populations (based on 2010 census data) for each census block whose centroid was within areas of high- and

medium-density smoke plumes. We confined our analysis to California and Nevada, because archived reports⁵ and AirNow maps⁶ did not indicate air quality impacts in other states despite evidence that Rim Fire smoke traveled as far as central Canada (Peterson et al. 2015).

Results of the Case Study

This comparison cannot prove that managing fire for resource objectives has reduced smoke impacts in a particular landscape compared with those for a suppression-centered strategy, but it illustrates how managing fires for resource objectives could reduce smoke impacts relative to those for more extreme fires. An actual experiment to compare the effects of managing fire for resource objectives at a scale large enough to evaluate major smoke impacts seems impractical given the enormous consequences, and modeling approaches face numerous challenges in representing the effectiveness of the suppression response and the impacts of low-probability or uncertain extreme events (Hasan and Foliente 2015).

Within the study area, daily emissions from both prescribed burns and resource objective wildfires remained well below 500 tons $PM_{2.5}$, whereas the Rim Fire had 20 days exceeding that threshold (nearly half of its entire period of active fire growth) and peaked at nearly 11,000 tons $PM_{2.5}$ /day on Aug. 26, 2013 (Figure 2). During the late summer, air quality is already problematic in downwind areas such as the Lake Tahoe Ba-

sin and San Joaquin Valley. In contrast, most of the fires managed for resource objectives had peak emissions either in the early summer or in the fall, when airshed conditions are often more favorable.

Modeled emissions from the Rim Fire within each vegetation polygon varied by an order of magnitude because of the different types of vegetation and amount of accumulated fuels (Figure 3A). However, daily emissions from the Rim Fire (Figure 3B) were quite high even in areas that had relatively light fuels (e.g., in the center of the fire, as shown in Figure 3A), because the fire burned through those areas so quickly.

The Rim Fire generated a surge in emissions that began on August 19 and continued through September 8, after which estimated daily emissions dropped below 265 tons (Figure 4B). That rapid growth resulted in high- and medium-density smoke plumes over large populations in California and Nevada between August 22 and September 10 (Figure 4D). We weighted the population estimates by the weights reported by Preisler et al. (2015) (36.5 and 17% for high- and medium-density smoke plumes, respectively), to estimate 2.9 million person-days associated with high smoke and 4.1 million person-days associated with medium density smoke or 7 million total person-days of exposure to higher than normal levels of $PM_{2.5}$ (Figure 4D). Ground-level monitoring indicated that these large smoke plumes coincided with highly polluted days in Reno, which occurred on August 23–25 and again on August 28–29, when $PM_{2.5}$ values exceeded the “unhealthy for all populations” standard ($55.5 \mu g/m^3$) (Figure 4F). Such high levels are such a serious health concern that people are advised to avoid going outdoors. Navarro et al. (2016) reported that very unhealthy and unhealthy days occurred at 10 air monitoring sites in the central Sierras, northern Sierras, and Nevada during the Rim Fire. They used BlueSky modeling calibrated with ground-level monitoring to estimate that the Rim Fire exposed 1.2 million people to smoke across 10 counties in California and Nevada during 37 days of active growth. Multiplying our estimate of person-days of exposure by the willingness to pay to avoid days of smoke impact found by Richardson et al. (2012) suggests that the cost of smoke impact may have been nearly \$600 million. That sum is comparable to the entire estimate of non-air quality losses in environmental benefits resulting from the Rim Fire (Batker et al. 2013).

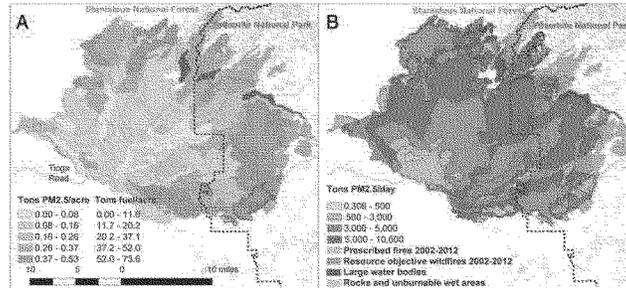


Figure 3. Fuel loading and estimated emissions of $PM_{2.5}$ per unit area within different vegetation polygons (A) and estimated emissions of $PM_{2.5}$ per day within daily progression polygons (B), within the Rim Fire.

The enormous spatial impact of the Rim Fire is illustrated by a map on August 31 (Figure 5), showing how plumes extended north from the Rim Fire over large urban populations in the Lake Tahoe Basin (55,607), Carson City (55,212), Sparks (90,264), and Reno (225,221), before shifting southward over Fresno (494,665), Madera (61,416), Visalia (124,442), and other cities in the Central Valley. Altogether, medium- and high-density HMS smoke from the Rim Fire on that day covered a large area (251,691 mi^2) with a population of 2.8 million people, more than 2 million of whom resided below high-density smoke. Within Yosemite Village, which had few of its typical visitors, levels exceeded the “very unhealthy” standard of $150 \mu g/m^3$ (Figure 5B) on that day.

In contrast, the Grouse and Harden Fires burned slowly over the early summer of 2009, with very modest emissions until the last week of June (Figure 4A). Both fires were managed over resource objectives using different tactics. For the Grouse Fire, managers used an intensive “push-pull” approach of checking the fire’s spread during periods of limited dispersion and speeding up the fire through aerial ignition during periods of favorable dispersion (Figure 6), particularly during its last week, while slowing the fire in wet drainages and when dispersion conditions were less favorable. Meanwhile, the Harden Fire was contained on its western flank and allowed to spread eastward toward natural barriers so that resources could be focused on managing the more complex Grouse Fire (van Wageningen 2012). Our analysis of HMS maps indicated that there were only 2 days when

medium-density plumes overlaid substantial populations in California and Nevada, amounting to 25,000 person-days (Figure 4C). Ground-level monitoring at Yosemite Village showed relatively modest impacts, where $PM_{2.5}$ levels remained between 30 and $55 \mu g/m^3$ from July 1 through July 6 (Figure 4E). Although these levels are considered “unhealthy for sensitive groups,” concentrations in Yosemite Valley due to local sources combined with regional wildfire impacts often reach or exceed such levels (Preisler et al. 2015).

By specifically evaluating smoke dispersal, our analysis shows that extremely large and intense fires like the Rim Fire presented a disproportionately greater public health hazard than did previous fires managed for resource objectives. Specifically, the Rim Fire burned 55 times more area (257,213 acres) than the combined footprint of the Grouse and Harden Fires (4,695 acres), but our analysis suggests that it had at least 275 times greater impact in terms of person-days, or 5.5 times greater impact relative to area burned. Impacts from the Rim Fire are even greater than suggested by those figures because of the increased hazard associated with unhealthy levels for the general population and high-density smoke plumes, neither of which was reported during the Grouse and Harden resource objective wildfires.

Potential Benefits of Resource Objective Wildfires

The framework can also be useful for comparing the public health impacts of fire management strategies across broader tem-

poral and spatial scales. Our analyses help to illustrate and begin to quantify many of the potential benefits of resource objective wildfires compared with those of extreme fires:

1. *Reduced fuels and reduced consumption.* Where fires burn over the footprints of relatively recent fires, emissions estimates should typically reflect lighter fuels and reduced crown consumption (Wiedinmyer and Hurteau 2010). We accounted for this effect within the 10,385 acres of the Rim Fire’s footprint that had experienced prescribed fires or resource objective wildfires since 2002 by changing “typical” fuel loads to “light,” which reduced estimated emissions in those areas by 53% and was consistent with the approach used by Stephens et al. (2007) (see Supplemental Table S1 for all the parameters used). Because recent reburns constituted only 4.0% of the entire Rim Fire area, accounting for those reduced emissions lowered the estimated emissions for the entire fire by only 3.2% (also see Supplemental Table S1). Had the entire area of the Rim Fire been treated with recent fire, its estimated emissions would have been reduced by 48% (see Supplemental Table S2), with most of the reduction due to the change of dead fuels from “typical” to “light.” Similarly, Wiedinmyer and Hurteau (2010) found that replacing infrequent wildfires with lighter prescribed burns would roughly halve fire emissions in dry forests in the Western United States, although they also noted that emissions would be more frequent under a prescribed burning scenario.
2. *More favorable dispersion and potential for*

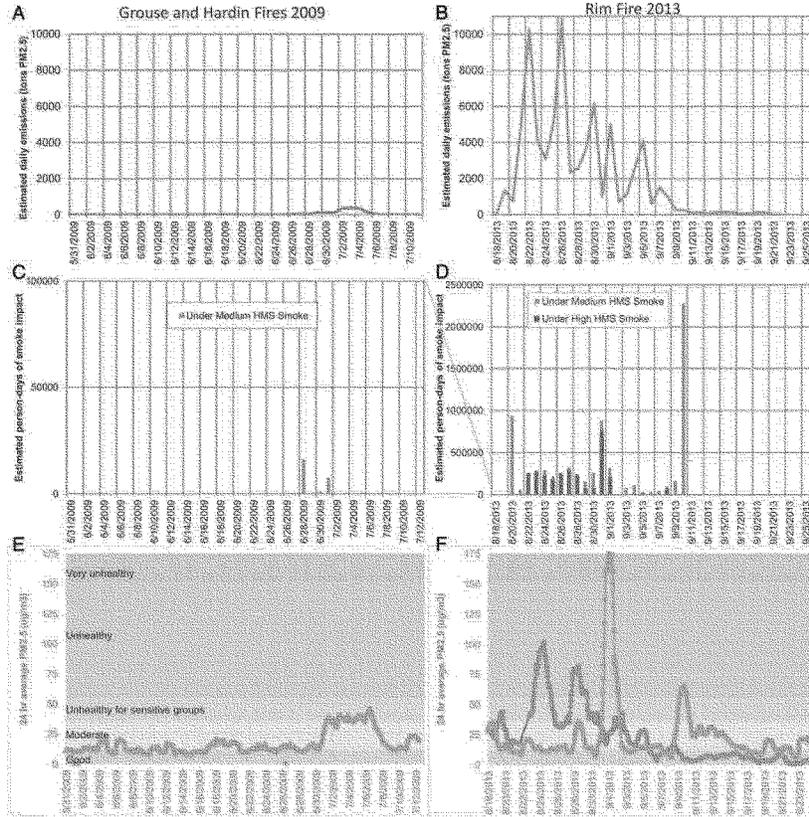


Figure 4. Comparisons between three measures of potential smoke impact during the Grouse and Harden fires of 2009 (left) and the Rim wildfire of 2013 (right), including estimated daily emissions (top); estimated person-days of smoke impact associated with medium- and high-density smoke plumes (middle, note that the y-axis scale on the chart of impacts during the Grouse and Harden fires [C] is 250 times smaller than the one for the Rim Fire [D]); and 24-hour rolling average $PM_{2.5}$ values (bottom, shown in relation to associated levels of health concern) for Yosemite Village, California, and Reno, Nevada (data were not available for Reno in 2009).

less ozone. As maintenance burns reduce fuel levels over time, managers may be able to burn more safely earlier in the summer and or later in the fall, when dispersion is often more favorable and ozone concentrations are lower (Jaffe et al. 2013). Fires managed for resource objectives are less likely to result in the

greater lofting and concentrations of smoke reported from extreme fires, which often deliver pollution to distant, large urban populations in lower-elevation valleys (Colarco et al. 2004, Peterson et al. 2015).

3. Greater ability to regulate fire spread. Because wildfires would be managed for

source objectives when weather and fire behavior conditions are more moderate than under extreme wildfires, their slower fire spread can curb daily emissions. In addition, managers can employ the push-pull tactics burn described for the Grouse Fire to regulate daily emissions based on monitored concentrations

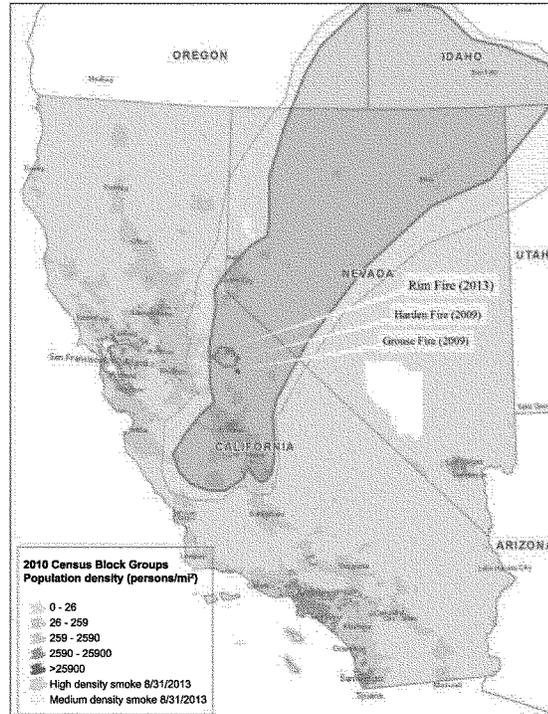


Figure 5. HMS smoke plumes from the Rim Fire on Aug. 31, 2013, a day of extensive heavy smoke impact, overlying population density of census tracts in California and Nevada.

or concentrations projected using tools such as the BlueSky framework. When dispersion is limited, firefighters can slow progression by herding the fire into barriers, roads, and areas of previous fuel reduction. Conversely, they can encourage fire growth during periods of favorable dispersion to dilute emissions. They can burn perimeters ("black-lining") under marginal dispersion conditions, just before a mild front arrives and then ignite larger interior areas aerially once more favorable dispersion arrives. Using such techniques requires resources and coordination among fire operations, air quality, and meteorology specialists.

4. *Creating anchors that facilitate future fire management.* In addition, strategic placement of relatively large resource objective fires within fire-prone landscapes can create anchors for limiting the spread of hazardous wildfires and increasing opportunities to use future wildfires for resource benefit (North et al. 2015). For example, the cumulative effect of decades of managing wildland fires for resource objectives in Yosemite National Park created opportunities to suppress the Rim Fire on its northern and eastern edge (Figure 3A). As fuels continue to accumulate and climate conditions increase the likelihood of large fires, such strategic use of

fire will become increasingly important for reducing the likelihood and extent of large-scale, extreme fires like the Rim Fire (Westerling et al. 2015).

A comprehensive comparison of smoke impacts under different management strategies is challenging to model because of complex processes (such as capacity to suppress or safely manage fires), feedbacks (such as changes in fuels, fire behavior, and emissions after fires), sensitivity to extreme events, and uncertainty of climate. Despite such challenges, smoke monitoring and smoke modeling are essential for guiding future management strategies, given changing climate and fire regimes (McKenzie et al. 2014).

Strategies to Support Greater Use of Fire

The framework and results of the case study suggest several management approaches to align ecological restoration with reduction in public health impacts through greater use of fire to achieve resource objectives.

Managing Fires Based on Direct Smoke Impacts

Although large-resource objective fires are challenging to implement and do not entirely avoid smoke impacts, the Grouse Fire and other resource objective fires (Schweizer and Cisneros 2014) have demonstrated that large areas can burn with relatively minor smoke impacts. An important strategy is to manage fires at least in part based on monitored smoke concentrations at key monitoring sites, rather than applying predetermined area limits or assuming a direct correlation with smoke impacts. This approach is directly responsive to human health impacts while providing greater flexibility to take advantage of favorable dispersion and treat more area during a given fire.

Public Communication to Reduce Smoke Impact and Support Use of Fire

Smoke exposure can be reduced by distilling monitoring and modeling tools into information that people can use to their modify behavior (Olsen et al. 2014, Rappold et al. 2014). The combination of advance warning and education can also increase public support for managing fire for resource objectives over time (Sneeuwjagt et al. 2013, Blades et al. 2014). It is important for outreach efforts to explain how for-



Figure 6. Fire managers pushed the Grouse Fire to spread during periods of favorable smoke dispersion, including times at night.

est management can mitigate smoke impacts from extreme fires not only in rural forest communities but also in downwind urban populations.

Engaging Air Resource Advisors

Air resource advisors, who are commonly assigned to large wildfire incident teams, can also help managers mitigate the negative health effects of prescribed fires and resource objective wildfires. Such trained specialists can facilitate public communication and prepare documents used by air quality regulators in permitting burns and considering exemptions for exceedances of air quality standards that might be caused by such fires.

Incentivizing Reduction of Smoke Impacts Rather than Area Burned

Rather than using area burned, public health objectives can be better met by measuring exceedances of health thresholds at monitoring sites or person-days of expected harm. Replacing unit-area fees on restorative burning with flat annual fees, as employed by some air districts, would reduce one of the disincentives for intentionally using large fires to restore landscapes (Sneeuwjagt et al. 2013).

Conclusion

The combination of a warming climate and accumulation of forest fuels ensures a future with more large fires and smoke in dry western US forests. We have outlined a

framework to more directly account for regional-scale smoke impacts from these events using surface monitoring and satellite observations of smoke. Managing large fires for resource objectives can shift the release of inevitable emissions to conditions that minimize large-scale smoke impacts, by controlling fire spread based on available dispersion and monitored impacts and creating anchors for containing future hazardous fires. When well supported by firefighting, air quality monitoring and modeling, and public communications resources, this approach can overcome existing disincentives for achieving ecological and public health goals.

Endnotes

1. For more information, see <http://playground.airfire.org>.
2. For more information, see www.aif.noaa.gov/HYSPLIT_info.php.
3. For more information, see src.com/calpuff/calpuff1.htm.
4. For more information, see www.epa.gov/benmap.
5. For more information, see inciweb.nwcc.gov/.
6. For more information, see airnow.gov/.

Literature Cited

AMERICAN LUNG ASSOCIATION. 2015. *Most polluted cities*. Available online at www.statoftheair.org/2015/city-rankings/most-polluted-cities.html; last accessed Jan. 12, 2016.

BARBERO, R., J.T. ABATZOGLOU, N.K. LARKIN, C.A. KOLDEN, AND B. STOCKS. 2015. Climate change presents increased potential for very

large fires in the contiguous United States. *Int. J. Wildl. Fire*, 24(7):892–899.

BATKER, D., Z. CHRISTIN, R. SCHMIDT, AND I. DE LA TORRE. 2013. *The economic impact of the 2013 Rim Fire on natural lands*. Earth Economics, Tacoma, WA. 53 p.

BLADES, J.J., S.R. SHOOK, AND T.E. HALL. 2014. Smoke management of wildland and prescribed fire: Understanding public preferences and trade-offs. *Can. J. For. Res.* 44(11):1344–1355.

CALIFORNIA AIR RESOURCES BOARD. 2015. *Smoke management program technical tools*. Available online at www.arb.ca.gov/smgy/techtool/techtool.htm; last accessed Apr. 2, 2015.

CAIKIN, D.E., M.P. THOMPSON, AND M.A. FINNEY. 2015. Negative consequences of positive feedbacks in US wildfire management. *For. Ecosyst.* 2(1):9.

CARROLL, M.S., K.A. BLATNER, AND P.J. COHN. 2007. Managing fire danger in the forests of the US inland Northwest: A classic “wicked problem” in public land policy. *J. For.* 105(5): 239–244.

CISNEROS, R., D. SCHWEIZER, H. PREISLER, D.H. BENNETT, G. SHAW, AND A. BYTNEROWICZ. 2014. Spatial and seasonal patterns of particulate matter less than 2.5 microns in the Sierra Nevada Mountains, California. *Atmos. Pollut. Res.* 5(4):581–590.

CLINTON, N., J. SCARBOROUGH, Y. TIAN, AND P. GONG. 2003. A GIS based emissions estimation system for wildfire and prescribed burning. P. 14 in *EPA 12th Annual Emission Inventory Conference*. US Environmental Protection Agency, Washington, DC.

COLARCO, P., M. SCHOFBERG, B. DODDRIDGE, L. MARUFU, O. TORRES, AND E. WELTON. 2004. Transport of smoke from Canadian forest fires to the surface near Washington, DC: Injection height, entrainment, and optical properties. *J. Geophys. Res. Atmos.* 109(D6):D06203.

CROSS, J.A. 2001. Megacities and small towns: Different perspectives on hazard vulnerability. *Global Environ. Change Part B Environ. Hazards* 3(2):63–80.

DAVIS, F.W., D.M. STOMS, A.D. HOLLANDER, K.A. THOMAS, P.A. STINE, D. ODION, M.I. BORCHERT, ET AL. 1998. *The California Gap Analysis Project*. Final Rep., Univ. of California, Santa Barbara, Santa Barbara, CA. 255 p.

DELFINO, R.J., S. BRUMMEL, J. WU, H. STERN, B. OSTRO, M. LIPSETT, A. WINER, ET AL. 2009. The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. *Occup. Environ. Med.* 66(3):189–197.

ENGEL, K.H. 2013. Perverse incentives: The case of wildfire smoke regulation. *Ecol. Law Q.* 40(3):623–672.

FINLAY, S.E., A. MOFFAT, R. GAZZARD, D. BAKER, AND V. MURRAY. 2012. Health impacts of wildfires. *PLoS Curr. Disasters*. Available online at <http://currents.plos.org/disasters/article/health-impacts-of-wildfires/>.

FOWLER, C. 2003. Human health impacts of forest fires in the southern United States: A literature review. *J. Ecol. Anthropol.* 7:39–59.

- FULE, P.Z., T.W. SWETNAM, P.M. BROWN, D.A. FAIK, D.L. PETERSON, C.D. ALLEN, G.H. APLET, ET AL. 2014. Unsupported inferences of high-severity fire in historical dry forests of the western United States: Response to Williams and Baker. *Global Ecol. Biogeogr.* 23(7):825–830.
- FUSSINA, L., S. ZHONG, J. KORACIN, T. BROWN, A. ESPERANZA, L. TARNAY, AND H. PREISLER. 2007. Validation of BlueSky Smoke Prediction System using surface and satellite observations during major wildland fire events in Northern California. P. 403–408 in *The fire environment—Innovations, management, and policy: conference proceedings, 26–30 March 2007, Destin, FL*. Butler, B.W. and W. Cook (comp.). USDA Forest Service Proc. RMRS-P-46CD. Rocky Mountain Research Station, Fort Collins, CO.
- GATHER, C.J., S. GOODRICK, B.E. MURPHY, AND N. FONDVAL. 2015. An exploratory spatial analysis of social vulnerability and smoke plume dispersion in the US South. *Forests* 6(5): 1397–1421.
- GOODRICK, S.L., G.L. ACHTEMEIER, N.K. LARKIN, Y. LIU, AND T.M. STRAND. 2013. Modeling smoke transport from wildland fires: A review. *Int. J. Wildl. Fire* 22(1):83–94.
- HASAN, S., AND G. FOULETTE. 2015. Modeling infrastructure system interdependencies and socioeconomic impacts of failure in extreme events: Emerging R&D challenges. *Nat. Hazards* 78(3):2143–2168.
- HUNTER, M.E., J.M. INIGUEZ, AND C.A. FARRIS. 2014. *Historical and current fire management practices in two wilderness areas in the southwestern United States: The Saguaro Wilderness Area and the Gila-Aldo Leopold Wilderness Complex*. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-325. Rocky Mountain Research Station, Fort Collins, CO. 38 p.
- HURTEAU, M.D., A.L. WESTERLING, C. WIEDENMYER, AND B.P. BRYANT. 2014. Projected effects of climate and development on California wildfire emissions through 2100. *Environ. Sci. Technol.* 48(4):2298–2304.
- JAFFE, D.A., N. WIGDER, N. DOWNEY, G. PFEISTER, A. BOYNARD, AND S.B. REID. 2013. Impact of wildfires on ozone exceptional events in the Western U.S. *Environ. Sci. Technol.* 47(19):11065–11072.
- JONES, B.A., J.A. THACHER, J.M. CHERMAK, AND R.P. BERRINS. 2016. Wildfire smoke health costs: A methods case study for a Southwestern US 'mega-fire.' *J. Environ. Econ. Policy* 5(2): 181–199.
- KOCHL, I., G.H. DONOVAN, P.A. CHAMP, AND J.B. LOOMIS. 2010. The economic cost of adverse health effects from wildfire-smoke exposure: A review. *Int. J. Wildl. Fire* 19(7):803–817.
- KUMAGAI, Y., M.S. CARROLL, AND P. COHN. 2004. Coping with interface wildfire as a human event: Lessons from the disaster/hazards literature. *J. For.* 102(6):28–32.
- LEENHOUTS, B. 1998. Assessment of biomass burning in the conterminous United States. *Conserv. Ecol.* 2(1):1.
- LIU, J.C., G. PEREIRA, S.A. UHL, M.A. BRAVO, AND M.L. BELL. 2015. A systematic review of the physical health impacts from non-occupational exposure to wildfire smoke. *Environ. Res.* 136:120–132.
- LUECK, D., AND J. YODER. 2015. The economic foundations of firefighting organizations and institutions. *J. For.* 113(3):291–297.
- LUTES, D.C. 2014. *First Order Fire Effects Model user guide version 6.1*. USDA Forest Service Rocky Mountain Research Station, Fort Collins, CO. 66 p.
- LYDERSEN, J.M., B.M. COLLINS, C.M. EWELL, A.L. REINER, J.A. FITES, P. GONZALEZ, D.S. SAHJ, AND J.J. BUTTLER. 2014. Using field data to assess model predictions of surface and ground fuel consumption by wildfire in coniferous forests of California. *J. Geophys. Res. Biogeosci.* 119(3):223–235.
- MCKENZIE, D., U. SHANKAR, R.E. KEANE, E.N. STAVROS, W.E. HELLMAN, D.G. FOX, AND A.C. RIEBAU. 2014. Smoke consequences of new wildfire regimes driven by climate change. *Earth's Future* 2(2):35–59.
- MILLER, J.D., AND H.D. SAFFORD. 2012. Trends in wildfire severity 1984–2010 in the Sierra Nevada, Modoc Plateau, and southern Cascades, California, USA. *Fire Ecol.* 8(3):41–57.
- MOELTNER, K., M.K. KIM, E. ZHU, AND W. YANG. 2013. Wildfire smoke and health impacts: A closer look at fire attributes and their marginal effects. *J. Environ. Econ. Manage.* 66(3):476–496.
- NAKAYAMA WONG, L.S., H.H. AUNG, M.W. LAME, T.C. WEGESSER, AND D.W. WILSON. 2011. Fine particulate matter from urban ambient and wildfire sources from California's San Joaquin Valley initiate differential inflammatory, oxidative stress, and xenobiotic responses in human bronchial epithelial cells. *Toxicol. In Vitro* 25(8):1895–1905.
- NAVARRO, K.M., R. CISNEROS, S.M. O'NEILL, D. SCHWEIZER, N.K. LARKIN, AND J.R. BALMES. 2016. Air-quality impacts and intake fraction of PM_{2.5} during the 2013 Rim megafire. *Environ. Sci. Technol.* 50(21):11965–11973.
- NGO, M.A., K.E. PINKERTON, S. FREELAND, M. GELLER, W. HAM, S. CLIFF, L.E. HOPKINS, ET AL. 2010. Airborne particles in the San Joaquin Valley may affect human health. *Calif. Agric.* 64(1):12–16.
- NORTH, M., B.M. COLLINS, AND S.L. STEPHENS. 2012. Using fire to increase the scale, benefits and future maintenance of fuels treatments. *J. For.* 110(7):392–401.
- NORTH, M.P., S.L. STEPHENS, B.M. COLLINS, J.K. AGEI, G. APLET, J.F. FRANKLIN, AND P.Z. FULE. 2015. Reform forest fire management. *Science* 349(6254):1280–1281.
- OFFICE OF THE FEDERAL REGISTER. 2015. *Treatment of data influenced by exceptional events, proposed rule*. Available online at www.federalregister.gov/articles/2015/11/20/2015-29350/treatment-of-data-influenced-by-exceptional-events; last accessed Dec. 11, 2015.
- OLSEN, C.S., D.K. MAZZOTTA, E. TOMAN, AND A.P. FISCHER. 2014. Communicating about smoke from wildland fire: Challenges and opportunities for managers. *Environ. Manage.* 54(3):571–582.
- PETERSON, D.A., E.J. HYER, J.R. CAMPBELL, M.D. FROMM, J.W. HAIR, C.F. BUTLER, AND M.A. FINN. 2015. The 2013 Rim Fire: Implications for predicting extreme fire spread, pyroconvection, and smoke emissions. *Bull. Am. Meteorol. Soc.* 96(2):229–247.
- PREISLER, H.K., D. SCHWEIZER, R. CISNEROS, T. PROCTER, M. RUMINSKI, AND L. TARNAY. 2015. A statistical model for determining impact of wildland fires on particulate matter (PM_{2.5}) in Central California aided by satellite imagery of smoke. *Environ. Poll.* 205:340–349.
- QUINN-DAVIDSON, L., AND J.M. VARNER. 2012. Impediments to prescribed fire across agency, landscape and manager: An example from northern California. *Int. J. Wildl. Fire* 21(3): 210–218.
- RAPPOLD, A.G., N.L. FANN, J. CROOKS, J. HUANG, W.E. CASCIO, R.B. DEVLIN, AND D. DIAZ-SANCHEZ. 2014. Forecast-based interventions can reduce the health and economic burden of wildfires. *Environ. Sci. Technol.* 48(18):10571–10579.
- RICHARDSON, L.A., P.A. CHAMP, AND J.B. LOOMIS. 2012. The hidden cost of wildfires: Economic valuation of health effects of wildfire smoke exposure in Southern California. *J. For. Econ.* 18(1):14–35.
- RUMINSKI, M., S. KONDRAGUNTA, R. DRAXLER, AND G. ROLPH. 2007. Use of environmental satellite imagery for smoke depiction and transport model initialization. In *16th Annual international emission inventory Conference: Emission inventories Integration, analysis, and communications*. US Environmental Protection Agency, Washington, DC. 16 p.
- SCHWEIZER, D., AND R. CISNEROS. 2014. Wildland fire management and air quality in the southern Sierra Nevada: Using the Lion Fire as a case study with a multi-year perspective on PM_{2.5} impacts and fire policy. *J. Environ. Manage.* 144:265–278.
- SCHWEIZER, D.W., AND R. CISNEROS. 2016. Forest fire policy: Change conventional thinking of smoke management to prioritize long-term air quality and public health. *Air Qual. Atmos. Health* 10(1):33–36.
- SNEEBUNJAGT, R.J., T.S. KLINE, AND S.L. STEPHENS. 2013. Opportunities for improved fire use and management in California: Lessons from Western Australia. *Fire Ecol.* 9(2):14–25.
- STEPHENS, S.L., R.E. MARTIN, AND N.E. CLINTON. 2007. Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. *For. Ecol. Manage.* 251(3):205–216.
- STEPHENS, S.L., AND N.G. SUGIHARA. 2006. Fire management and policy since European settlement. P. 431–443 in *Fire in California's ecosystems*. Sugihara, N.G., J.W. van Wagtendonk, J. Fites-Kaufman, K.E. Shaffer, and A.E. Thode (eds.). Univ. of California Press, Berkeley, CA.
- STRAND, T.M., N. LARKIN, K.J. CRAIG, S. RAPPOLD, D. SULLIVAN, R. SOLOMON, M. RORIG,

- N. WHEELER, AND D. PRYDEN. 2012. Analyses of BlueSky Gateway PM2.5 predictions during the 2007 southern and 2008 northern California fires. *J. Geophys. Res. Atmos.* (1984–2012) 117(D17):D17301.
- TRAINOR, S.F., M. CALEE, D. NATCHER, F.S. CHAPIN, A.D. MCGUIRE, O. HUNTINGTON, P. DUFFY, ET AL. 2009. Vulnerability and adaptation to climate-related fire impacts in rural and urban interior Alaska. *Polar Res.* 28(1):100–118.
- US CENSUS BUREAU. 2015. *2010 census urban and rural classification and urban area criteria*. Available online at www.census.gov/geol/reference/ua/urban-rural-2010.html; last accessed Apr. 8, 2015.
- US ENVIRONMENTAL PROTECTION AGENCY. 2016. *AirNow-Tech Database*. Available online at airnowtech.org/; last accessed Jan. 11, 2016.
- VAN WAGTENDONK, K. 2012. Fires in previously burned areas: Fire severity and vegetation interactions in Yosemite National Park. P. 356–363 in *Rethinking protected areas in a changing world: Proc. of the 2011 George Wright Society biennial conference on parks, protected areas, and cultural sites*, Weber, S. (ed.), The George Wright Society, Hancock, MI.
- WEGESSER, T.C., K.E. PINKERTON, AND J.A. LAST. 2009. California wildfires of 2008: Coarse and fine particulate matter toxicity. *Environ. Health Perspect.* 117(6):893–897.
- WESTERLING, A.L., J. MILOSTAN, AND A.R. KEYSER. 2015. *Modeling potential fire impacts with landscape vegetation scenarios and changing climate for the Sierra Nevada and other areas in the Western US*. Final Rep. US For. Serv. Cooperative Agreement, Washington, DC.
- WIEDENMYER, C., AND M. HURTEAU. 2010. Prescribed fire as a means of reducing forest carbon emissions in the Western United States. *Environ. Sci. Technol.* 44(6):1926–1932.
- WILLIAMS, J. 2013. Exploring the onset of high-impact mega-fires through a forest land management prism. *For. Ecol. Manage.* 294: 4–10.
- YAO, J., M. BRAUER, AND S.B. HENDERSON. 2013. Evaluation of a wildfire smoke forecasting system as a tool for public health protection. *Environ. Health Perspect.* 121(10):1142–1147.
- YOSEMITE NATIONAL PARK. 2012. *Fire history geodatabase for Yosemite National Park*. Available online at irma.nps.gov/App/Reference/Profile/2188901; last accessed Dec. 14, 2015.

Senator CANTWELL. Now I know this probably makes sense to people, but at the same time this is one of the dilemmas we have been fighting. I guarantee if you asked people in Puget Sound, would you tolerate a little bit of smoke in those months (May, June) to reduce the constant summer-wide haze that was present because of August wildfires...I guarantee you, they would say "yes." "Let's do the prescribed burning in the months that are wet, to help us control these burns in the most effective way."

Obviously we have more work to do on that, but I think that article showed us this is among the wisest spending that we could do, and we just need to push through on this.

I will also be asking Chief Christiansen about the shift to call-when-needed contracts for 35 percent of the air tankers and water scoopers, including Aeroflight in Spokane. I want to make sure that you have every tool available to you, and I want to make sure we are making the best, most cost-effective decisions and you are not just going with something because it can be funded from the newly authorized larger pot of money. I would feel better sleeping at night if you had every tool available.

We know that water alone does not put out the fire, nor does fire retardant, but it does buy time until firefighters can get there. With this many fire starts in this dry of a season, having that kind of air ability to help mitigate is so, so important to these communities. With communities that are so stretched when the entire upper part of Northwest Washington and Northeast Washington is on fire, basically, communities were defending themselves.

I understand that, well, we'll get the air tankers. I just want to say that the last year fire managers requested, but did not receive, an air tanker 371 times because none were available. I get that your goal is to have the most resources. I want you to have the most resources too. But I don't want you to have to give up one for the other.

So let's work together on figuring out how we get you both in what is going to continue to be a challenging fire environment.

Madam Chair, we just can't work fast enough. The changing climate and environment is making fire a more challenging environment for our Forest Service, for our wildland firefighters, for our communities. We put a down payment on it, but we need to do so much more.

I thank everybody, and thank you for having this important hearing today.

The CHAIRMAN. Thank you, Senator Cantwell.

We will now turn to our witnesses this morning.

Ms. Christiansen, again, welcome, as the Interim Chief of the U.S. Forest Service at the Department of Agriculture. We appreciate you being here and your leadership.

If you would please proceed.

We would ask you both to try to keep your comments to about five minutes so we have opportunities for questions.

We do have two votes that are scheduled to begin at 11:00 a.m., but we will power through them so that we can allow members to ask their very timely questions to a very timely issue.

Welcome, Ms. Christiansen.

**STATEMENT OF VICTORIA CHRISTIANSEN, INTERIM CHIEF,
U.S. FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE**

Ms. CHRISTIANSEN. Madam Chair, members of the Committee, thank you for inviting me back to testify.

I'd like to touch on three topics today: The Wildfire Outlook and our preparations to respond; our progress to increase work to improve forest conditions and reduce fire risk; and then update you on our actions to create a safe, respectful workplace.

Above-average wildfire activity appears to be our new normal. Forecasters predict 2018 will rival last year's historic season when the Federal Government spent \$2.9 billion fighting fires.

They predict above-average significant fire potential in 11 Western states at various times between now and the end of September as Senator Cantwell displayed.

Firefighting is not solitary work. No one organization can do it alone. We rely on the cooperation and shared resources with states, tribes, federal agencies, and local partners. With our collective resources, we maintain what we need to effectively respond.

The Forest Service itself has 10,000 firefighters, 900 engines and hundreds of available aircraft. Our firefighting efforts suppress 98 percent of all fires at ten acres or less. We are also taking steps to better manage costs for fire response. We know there is no blank check.

We will make decisions to ensure we spend dollars in the right place that will make a difference. We are evaluating and reducing cost centers to ensure we are most effective and efficient with taxpayer dollars.

In addition to wildfire response, our work is equally about improving forest conditions and providing for uses and experiences and services.

With the help of Congress, we are equipped with new tools and the fire funding fix to help us get more done. It's our time to deliver, and we are making steady progress.

By June 8th, all of our regions will submit two-year plans that will demonstrate how they are going to employ the new authorities. They'll include the modified Good Neighbor agreements, use of new categorical exclusions for wildfire resilience, and optimal locations for the 20-year stewardship contracts.

We also look forward to submitting our blueprint to reduce hazardous fuels in high risk areas.

We are already seeing increased results.

We will sell 3.4 billion board feet of timber this year while improving resiliency and health on more than three million acres.

We have increased the number of acres we treated by 36 percent. Timber harvest rose 13 percent from last year, and we are delivering it earlier in the year. At this point, we have harvested nearly 30 percent more timber than we did last year. Our 2018 timber target is the highest it's been in two decades.

We have also strengthened cooperation with states and other partners to do more work. Our increased work with states has resulted in 150 Good Neighbor agreements in 34 states. One agreement in Utah resulted in 36 projects that will treat over 50,000 acres.

Meanwhile, we are fundamentally reforming our internal processes and it's paying off. We are streamlining our planning over the last eight months, and it's decreased the time to authorize projects. This has reduced costs in just these eight months by \$30 million. We are updating our technology to expedite timber sales and our shovel-ready work has also increased to build on our momentum for 2019.

There is much more work to do, but we are off to a productive start.

Finally, our mission success does depend highly on a skilled, motivated workforce. We will continue to act with urgency to end harassment and retaliation in the Forest Service.

Next week, over 30,000 employees will take part in a full-day session called, Stand Up for Each Other. Employees will receive a new code of conduct and mandatory anti-harassment training with our broad, new policy.

You have my personal commitment to do whatever it takes to bring about a permanent culture change in the Forest Service. This level of commitment goes for all the work we do. We will ensure your investments make a difference to Americans who deserve healthy, productive forests and a government that works for them.

Thank you, Madam Chair, members of the Committee, I'm happy to answer your questions.

[The prepared statement of Ms. Christiansen follows:]

**Statement of Victoria Christiansen, Interim Chief of the USDA Forest Service
Before
The Senate Committee on Energy and Natural Resources
Concerning
The 2018 Wildland Fire Outlook and Wildland Fire Management Programs.
June 5 2018, 10:00 a.m.**

Madam Chairman and members of the Committee, thank you for inviting me to testify on the agency's efforts to prepare for and respond to wildfires and improve the condition of America's forests and grasslands. I appreciate the Committee's continued support and your recognition that this work goes beyond wildfire response, and is as much about proactively creating healthy, fire-resilient conditions on National Forest System lands so they provide for the uses, experiences and services that meet the needs of our Nation. This Congress provided valuable tools in the Consolidated Appropriations Act of 2018 (2018 Omnibus) that will allow the agency to carry out projects that help reduce the threat catastrophic wildfires and other forest threats pose to lives, homes and communities. We will take advantage of the opportunities presented in the 2018 Omnibus and work diligently to deliver desired results.

2018 Wildfire Year

Last year was one of the most devastating wildfire years on record. Tragically, dozens of Americans were killed, including 14 wildland firefighters who perished while working to protect lives and property. Communities in the Great Plains, the Southeast, Southwest and the West were affected, with more than 10 million acres burned—an area larger than the state of Maryland—and more than 12,300 homes and other structures destroyed. It was also the most expensive year for wildfires on record: For the first time ever, we spent \$2.9 billion dollars to suppress wildfires across the nation.

Early predictions indicate that 2018 will likely be another challenging wildfire year. According to the forecast released by the National Interagency Fire Center on June 1, 2018, significant portions of the western United States are predicted to have above average potential for significant wildfire activity between now and the end of September. States likely to be affected include Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Washington. To date, about 1.7 million acres have burned, mostly in the South, Southwest and Rocky Mountain regions; this number is on trend with the number of acres burned last year at this time. Wildland firefighting is not a solitary effort, and we rely on federal, tribal, state and local partners to provide a sustained and effective response across jurisdictions. This year the Forest Service and our partners have more than 10,000 firefighters, 900 engines, and hundreds of aircraft available to manage wildfires. At this time, we believe these to be adequate resources to address wildfire activity but will continue to evaluate our needs as the fire year progresses.

Recent trends in wildfire response data suggest that increasing suppression activity appears to be the new normal. In adjusting to this new normal, the authorities provided in the 2018 Omnibus are key.

I am especially appreciative of the solution to our fire funding dilemma. It is a challenge we have struggled with and worked on together for well over a decade. In fiscal year 2020, this comprehensive fire funding fix will ultimately stabilize our operating environment by addressing the impact of the rising suppression budget on forest management and research, and by treating catastrophic wildfires as natural disasters. Congress has dramatically reduced the need for transferring funds from our other mission programs so we can cover firefighting costs. We now have new tools and expanded authorities to help us do more to improve the conditions of our forests and grasslands. We will step up to this challenge and will do our part as an agency to get more work done on the ground.

Again, we are already developing more efficient and effective ways to do our work while taking steps to contain fire costs and ensuring we spend dollars in the right places to make a difference. We expect to demonstrate this commitment as we confront the 2018 fire year. Moreover, will continue our internal reforms, especially in active forest management that will result in changing overly complex, time-consuming, outdated processes that delay our work on the ground. Coupled with the expanded authorities, these reforms will translate to more favorable results, production and work in our nation's forests.

Forest Management

Congress has been very helpful in recent years, providing a number of authorities to help us get more work done on the ground. Thank you – it is helping, and we are making progress. For example, the Good Neighbor Authority (GNA) provided in the Agricultural Act of 2014, and expanded by the 2018 Omnibus, has dramatically increased our cooperation with states. We now have 150 agreements in 34 states using this authority. This shared stewardship approach has generated more trust and allowed significantly more work to get done.

While the total number of GNA agreements shows real progress, that number alone does not tell the whole story. For example, in the State of Utah a single 10-year agreement between the Forest Service and the state has yielded 36 projects that will treat over 50,811 acres of National Forest System lands in Fiscal Year 2019 alone.

The new authorities provided by Congress in the 2018 Omnibus give us more tools to increase forest treatments. The combination of these new tools and the fire funding fix are already changing the way we get work done-it's no longer business as usual. Since the 2018 Omnibus was signed into law, we analyzed the new tools technically and legally, provided explicit guidance to the field, and have required the Regions to submit their plans for implementing the authorities by June 8, 2018. More immediately we have directed the Regions to modify their Good Neighbor Agreements and use the new categorical exclusion for wildfire resilience projects. The new categorical exclusion will also be available for post fire treatments this year. In addition, we are actively working with our Regions and industry partners to identify the best areas to initiate 20-year stewardship contracting, thereby maximizing in the development of new infrastructure to process forest products.

Outside of increasing the use of new Congressional authorities, we have been very aggressive on improving our processes administratively to reduce the time and cost to plan and implement work on the ground. It's paying off. Our focus to streamline planning over the past eight months has decreased the time necessary to authorize projects, reduced costs by nearly \$30 million, and resulted in more shovel ready work. But we know there is more to do.

We are also putting into place a national risk-based strategy to address wildland fuels. To that end, this year we have increased acres treated by 36 percent and timber harvest by 13 percent over last year's levels. Compared to last year, we have nearly 30 percent more timber harvested at this point in the year. Our anticipated level of timber harvest in Fiscal Year 2018 is the highest it's been in 20 years. In all, this year the Forest Service plans to sell 3.4 billion board feet of timber while improving the resiliency and health of more than 3 million acres of National Forest System lands through removal of hazardous fuels and stand treatments.

Our implementation of vegetation treatment is also getting more efficient. We have trained personnel and industry partners in every region to use designate by prescription and description methods. We have also delivered updated technology to our personnel in the field, designed to reduce the time it takes to administer a timber sale, moving us closer to industry standards.

While we are pleased with the progress we are making, we recognize that the successful delivery of services and work starts with a highly skilled, motivated workforce. Forest Service employees remain our largest and most important investment. They are essential to confronting the arduous challenges facing America's forests and grasslands. They are integral to the services and experiences we provide to citizens and local communities. A safe and respectful work environment is the foundation for everything we do at the Forest Service. We simply cannot succeed without it. The next step toward this end will be during the week of June 11 when every Forest Service employee will participate in a daylong event called *Stand Up for Each Other*. Our local leaders will convene learning sessions designed to show how we as Forest Service employees can better support each other so that we all feel valued and respected. We expect the following outcomes for all Forest Service employees from *Stand Up for Each Other*: employees will understand that harassment, assault, bullying and retaliation are absolutely unacceptable behaviors; they will all know what to do if we experience or witness unacceptable behaviors; and, our agency as a whole will have built a collective capacity among employees to *Stand Up for Each Other*. We will continue to work in the weeks and months ahead to create the work environment each and every one of us deserves.

That concludes my testimony, Madam Chairman. I would be happy to answer any questions you or the Committee members have for me.

The CHAIRMAN. Thank you, Ms. Christiansen.
Mr. Rupert, welcome to the Committee.

**STATEMENT OF JEFFERY RUPERT, DIRECTOR, OFFICE OF
WILDLAND FIRE, U.S. DEPARTMENT OF THE INTERIOR**

Mr. RUPERT. Good morning, Chairman Murkowski, Ranking Member Cantwell, members of the Committee. Thank you for the opportunity to appear before you this morning to discuss the 2018 outlook and the Department of the Interior's fire management program.

As we've already heard this morning, 2018 is shaping up to be another challenging year. The cumulative impacts of drought, invasive species, and the steady accumulation of vegetation are creating landscapes that are more susceptible to large, devastating, and costly wildfires.

So far this year we've seen large fires in the South, the Midwest, and especially in the Southwest. And by all indications, we can expect the fire season in the West to be comparable to recent years as the outbreak of major wildfires over the weekend in New Mexico and Colorado demonstrate.

Together with our partners, we will continue to mobilize Department personnel, to deploy engines, single-engine air tankers, and other firefighting assets in support of a fully interoperable firefighting effort.

As Secretary Zinke and Secretary Perdue recently reaffirmed to all wildland fire leadership in both Departments, the protection of firefighters and public safety is the top priority for every wildland fire activity and management decision.

Effective wildfire response is also built on trust, on teamwork, and on collaboration among firefighters and their partners. A workplace that's free from harassment and where all members of the firefighting community have a strong trust relationship with their colleagues is critical to achieving a safe and effective response.

The Department of the Interior's recently implemented comprehensive anti-harassment policy takes meaningful steps to address harassment by stepping up training and establishing a clearly defined complaint and resolution process so that all employees, including those on the fire line, can focus on the mission.

To reduce the threat of wildfires, it's critical that we take a more active approach to the management of vegetation on our nation's forests and rangelands. In a directive to all Department of the Interior field personnel, Secretary Zinke emphasized the importance of active management as a way to reduce hazards and establish fire resilient landscapes and communities.

A cornerstone of this policy is the integration of vegetation management in all resource management planning as a way to reduce fuels and improve forest and rangeland health, protect people's lives and their communities, and prevent catastrophic wildfires.

Vegetation management, either done collaboratively with our partners or done directly by bureaus on Department managed lands, is one of the most effective strategies for mitigating wildfire risk. Coupled with more aggressive vegetation management, technology is helping us to prevent and manage catastrophic wildfires.

The use of unmanned aircraft systems, or UAS, is a perfect example of technology and leveraging it to fight wildfires in safer and more efficient ways. Last year, the Department conducted over 700 UAS missions on more than 70 wildfires, and we're on track to surpass that this year. The versatility of UAS is making a big difference in the way that we're fighting wildfires. UASs provide real time data and information that's used to improve surveillance and reconnaissance by assisting firefighters with detecting hot spots, improving mapping and increasing the effectiveness of monitoring.

We're also exploring a number of new technologies including applications and alert systems that improve firefighter safety and collaboration with the Department of Defense.

I would also like to point out that the Department is widely using UASs to support natural resource management and for search and rescue missions.

For example, last week the USGS, the U.S. Geological Survey, carried out a search and rescue mission in Hawaii at the Mount Kilauea volcano. Using infrared sensors, a UAS spotted an individual cornered by a lava flow. The remote pilot, using the UAS, was able to safely navigate the individual to a search crew that ultimately led the person out of harm's way.

So we look forward to working collaboratively with our partners throughout the wildland fire community to continue to build on these and other efforts in ways that support the safety of firefighters and the public, enhance our firefighting capabilities, and strengthen relationships with our partners.

I hope it goes without saying, but I'll say it anyway, thank you for the sustained support of this Committee for the entire wildland fire community and thanks again for the opportunity to discuss the Department's program.

I'm happy to answer any questions. Thank you.
[The prepared statement of Mr. Rupert follows.]

**Statement of
Jeffery Rupert
Director, Office of Wildland Fire
U.S. Department of the Interior
Before the
Senate Committee on Energy and Natural Resources
Oversight Hearing on the 2018 Wildland Fire Outlook and the Department of
the Interior's Wildland Fire Management Program
June 5, 2018**

Chairman Murkowski, Ranking Member Cantwell, and members of the Committee, thank you for the opportunity to provide testimony on the Department of the Interior's (Department) Wildland Fire Management (WFM) program.

The Office of Wildland Fire (OWF) coordinates the Department's WFM policies and budget for the Department's fire bureaus, including the Bureau of Indian Affairs (BIA), the Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), and National Park Service (NPS). OWF is also responsible for coordinating with other Federal agencies, Tribes, states, and external partners to establish effective program performance and oversight and ensure the programmatic efficiency of all aspects of the WFM program. These efforts support a collaborative approach to wildland fire management and promote the broad wildland fire community goals of: 1) restoring and maintaining fire-resilient landscapes; 2) creating fire-adapted communities that will withstand the effects of a wildfire without the loss of life and/or property; and 3) safely and effectively responding to wildfire.

OWF recognizes the absolute importance of collaboration if we are to significantly reduce wildfire risk to wildland firefighters, communities, and landscapes. The success of the WFM program is dependent upon successful collaboration across the program. Partnerships are vital to DOI's broad land stewardship responsibilities, including the implementation of fuels management work that helps reduce fire risk; post-fire rehabilitation work that helps restore landscapes and watersheds; and data, predictive tools, and the use of new technology to provide information needed for fire practitioners and decision makers.

The integration of fire management with resource management planning across the Department is the cornerstone in Secretary Zinke's Wildland Fire Directive and a core principle of the WFM program. Through more active management of our nation's public lands, we can reduce the threat of large and costly catastrophic wildfires. For instance, fuels management – including prescribed fire, chemical treatments, and other applications – and other land management activities that reduce vegetation can equally influence wildfire behavior and promote the safety and effectiveness of wildfire response, safeguard communities and infrastructure, and protect the public and our firefighters. At the same time, these projects enhance wildlife habitat and help watersheds become more resilient to the effects of wildfires.

In advancing the goals of the WFM program, OWF recognizes the importance of developing and adopting advanced or emergent technologies. This is critical to becoming a more efficient,

integrated, and effective wildland fire management organization. The Department continues to be the leader in the research, development, and practical deployment of Unmanned Aircraft Systems (UAS), or drones, on wildland fire management operations. Currently, the Department uses UASs to assist firefighters in gaining a tactical advantage on wildfires by allowing them to improve their surveillance and reconnaissance capabilities. The data collected by UASs is used to detect hotspots, improve mapping, and monitor incidents and operations. These advancements support the safety of our firefighters and the public and allow us to be better positioned to address wildfire. Through an increasingly robust UAS program, we continue to be innovative and improve our operational efficiency.

Summary of the 2017 Fire Year

The 2017 fire year was very challenging. Seattle, Washington and Missoula, Montana, set records for their longest historic periods without measurable rainfall. Hot and extremely dry conditions persisted in California from early Fall to the end of the calendar year. More than 71,000 wildfires burned over 10 million acres of Federal, Tribal, state, and private lands. The Department of the Interior and the USDA Forest Service collectively spent \$2.9 billion on suppression operations, the largest amount ever. There were more than 1,400 large or significant wildfires in 2017, compared to 1,251 in 2016.

In 2017, our nation suffered the tragic loss of 53 civilians and 14 firefighters, while an additional 21 persons died in debris flows in the aftermath of wildfires. Published research strongly suggests that smoke impacts from wildfires in 2017 have very likely caused or contributed to even more fatalities. Besides the direct impacts of wildfires, 2017 will be remembered as the “Year of the Smoke” across many communities, some well downwind of any wildfires. Additionally, more than 12,000 structures were destroyed, including nearly 8,100 residences and over 200 commercial structures.

To supplement the Federal wildland firefighting force, in July, the National Guard mobilized C-130 aircraft equipped with modular airborne firefighting systems from Washington, Colorado, Arizona, Nevada, and Wyoming to provide aerial support for nearly two months. In addition, 200 soldiers and 50 support staff from the 23rd Brigade Engineer Battalion, 7th Infantry Division, from Joint Base Lewis-McChord in Washington provided additional ground support for 30 days fighting wildfires in Oregon. The nation also received international support from Canada in 2017.

The 2018 Fire Season

Secretary Zinke and Secretary Perdue have affirmed in a joint letter to agency managers that was released in early May of 2018 that firefighter and public safety remains paramount in all firefighting operations. Before engaging in any wildland fire activity, we fully evaluate risks with a broad perspective and consider the people we serve and the resources we protect. Given predicted weather trends and vegetative conditions across many areas, we can expect another challenging wildfire season.

The National Significant Wildfire Potential Outlook, issued by the Predictive Services Unit at the National Interagency Coordination Center, shows the Western fire season continued to increase in activity across the Southwest in May, while conditions across the central and southern Great Plains gradually improved. Concerns across southern California will remain high due to existing drought conditions; the Southwest's Four Corners region also remains in extreme or exceptional drought. Conditions in Alaska this spring suggest a normal seasonal transition. While some areas of abnormally dry conditions exist across portions of the southwestern interior of Alaska, large fire potential has remained near normal.

Wildfire activity across the Southwest is expected to peak in May and June. Above normal significant large fire potential is expected across the southern tier of the region during this period as drought conditions intensify. Similar conditions will continue to promote above normal potential across southern California, because fine dead fuels have persisted from rains early last year, and because of an extended drought that continues to cause shrub mortality. In Alaska, above average temperatures and near average precipitation across the state's interior is expected to lead to significant large fire potential in June.

Wildland Firefighting Assets

The Department plans to deploy over 4,000 firefighting personnel this year, including 155 smokejumpers, 16 interagency hotshot crews, 4 Tribal hotshot crews, 3 other Tribal crews, and 6 Veteran hand crews. In addition, the Department will provide nearly 1,200 support personnel (for example, members of Incident Management Teams, dispatchers, and fire cache staff) and will have nearly 750 pieces of specialized heavy equipment available for use, including 631 engines, and other assets such as water tenders and dozers.

The Department will have access to 89 single engine air tankers, 14 water scoopers, 300 helicopters on call-when-needed contracts, and 36 additional helicopters on exclusive use contracts. These aviation resources are deployed in synergy with the large air tankers and lead planes on contract with USDA Forest Service.

We want to emphasize that these resources complement other Federal, Tribal, state and local resources, as well as those specifically made available by rural fire districts. Together, these assets form the foundation of an interoperable, collaborative approach to joint wildland firefighting. As you all know, the "fire season" has become extended in many parts of the country, and collectively is now often referred to as the "fire year." This has become increasingly challenging to the Department and nearly all our wildland fire management partners.

Active Management/Fuels Management

As referenced earlier, the Secretary's Wildland Fire Directive sets the vision for the Department's strategy for advancing a more active management approach to the stewardship of the nation's public lands. It is critical that all available tools, including the use of fuels management, be fully integrated into our Fire Management Plans and resource management plans. Some of the forest management provisions included in the 2018 Omnibus support these

efforts by authorizing certain activities that promote more active management. The Department would like to continue working with the Committee to explore opportunities for providing additional authorities that expand our toolbox to yield greater flexibility to more effectively mitigate wildfire behavior, improve forest and rangeland health, and safeguard communities, people, and firefighters.

The management of fuels also plays a central role in mitigating wildfire behavior, enhancing wildfire response, and increasing the resiliency of Department and Tribal lands. The active management approach is also a strategy of adaptive management that includes monitoring, assessments, evaluations and adjustments based upon each treatment's level of success in reaching management goals. This feedback loop informs land managers of treatment effectiveness and facilitates any necessary changes to maximize benefits. It also affords the Department the opportunity to strategically target areas for fuel management work.

For example, in 2017 a mowing treatment in the BLM Nevada Elko District protected homes north of Elko, Nevada, when a wildfire stopped once it intersected with this treatment. The use of engines, bulldozers, and hand lines was not necessary to control the wildfire because of the strategic placement of the fuel treatment. As a result, a community was protected, suppression funds were saved, and no firefighters were placed in harm's way. Equally important, this treatment helped spotlight an effective active management strategy to safeguard people and communities that could potentially be utilized in other similar areas or situations.

The Department's WFM program works collaboratively across jurisdictions with other Federal agencies, Tribes, states, and local governments, and private landowners to provide a framework for sharing costs, resources, tools, products, lessons learned, and innovations. For example, the Mid-Columbia National Wildlife Refuge Complex in Washington State collaborates with the nearby Gifford Pinchot National Forest to implement prescribed fire projects. This joint effort increases capacity and strengthens efficiencies to safely reduce hazardous fuels and restore fire resiliency. This pooling of resources to manage areas where some of the greatest concerns exist allows us to focus our fuels management efforts. In FY 2018, the Department is focusing some of its efforts in helping the Department of Homeland Security secure the border by assisting with targeted fuels management work that will allow Border Patrol to more effectively carry out its border security operations. This work will have the added benefit of reducing the threat of wildfires and restoring and enhancing important wildlife habitat.

So far in FY 2018, the Department has completed fuels treatments on 773,786 acres, of which 397,219 acres are located within the wildland-urban interface. The Department's total target level this fiscal year is 980,000 acres of treatments. Examples of fuels treatments include the use of prescribed fire, thinning of unnaturally overstocked forest stands and removal of encroaching trees onto grasslands, and targeting control of invasive species, such as Phragmites in coastal watersheds or cheat grass within the western interior. Fuels management also includes creating or enhancing defensible space around homes that meet fire safe standards to increase the chance for homes or other structures to survive when a wildfire moves through the community. Across the country, active management on Department lands and across our boundaries with our neighbors is critical to enhancing the safety and effectiveness of wildfire response, reducing wildfire risk, and safeguarding communities.

Coordination & Partnerships

Planning, active management, and coordinated operations are cornerstones of wildland fire management partnerships. OWF cultivates partnerships to foster collaboration with Federal partners, Tribes, state and local governments, and other stakeholders to significantly reduce fire risk to wildland firefighters, communities, and landscapes. Partnerships are key to the Department's land stewardship responsibilities, including the application of fuels management work that helps reduce fire risk; post-fire rehabilitation work that helps restore landscapes and watersheds; and fire science that provides information needed for fire practitioners and decision makers.

One such example is a partnership between the Conboy Lake National Wildlife Refuge and the Mount Adams Resource Stewards in southern Washington. Beginning in 2017, and again this year, refuge staff and the local Resource Stewards have worked together to develop prescribed fire treatments for hundreds of acres that benefit both the Refuge and the adjacent Mt. Adams Community Forest. This collaborative approach means that projects on the Refuge and the Community Forest are more effective at making communities safer, restoring forest health, and supplying sustainable local wood products and jobs.

Community wildfire protection plans (CWPP) are a powerful tool for helping communities to prepare for and reduce the risks of wildfire. CWPPs help identify the local threats of wildfire and establish a plan for protecting public safety, community sustainability, and natural resources. All plans require collaboration between stakeholders, including Federal agencies, Tribes, and state and local agencies. CWPPs establish priorities for fire protection looking at where fire risk is greatest due to the buildup of burnable vegetation. Based on community input, the plans provide recommendations for making structures less likely to catch fire and to reduce impacts to other resources valued by communities. From southern California to some of the newer plans in eastern Tennessee that were created in response to the devastating Chimney Tops 2 wildfire in 2016, CWPPs provide a way for communities to increase safety and manage wildfire risk.

The Wildland Fire Leadership Council (WFLC) – an intergovernmental group comprised of Federal, Tribal, state, county, and municipal officials – provides a forum for partners to communicate and improve collaboration on a broad range of wildland fire management issues. WFLC is most effective at bringing together diverse stakeholders to develop integrated and collaborative responses to wildland fire management policies and strategies that affect local communities across the country. Most recently, the WFLC partners are working together to find opportunities to better identify wildfire risk; address air quality issues by working collaboratively with the states to promote fuels management; and leverage advancement in technology to improve firefighting capabilities.

Development and Use of Technology

The UAS program is a perfect example of leveraging technology to fight fires in safer and more efficient ways to ensure that the Department is protecting communities, the public, and

firefighters. Coupled with more aggressive fuels management, this technology is helping prevent and manage catastrophic wildfires.

Technology, especially UAS or drone technology, helps fire managers get better data to manage fires faster and safer than ever. The Department's Office of Aviation Services, working with the Department's bureaus and offices, uses drone flights to support natural resource management across the country. Drones are highly versatile and configured to work with a wide array of sensors. The Department's drone program is widely recognized as the largest, most diverse, and successful domestic drone program. In 2013, the Federal Aviation Administration granted the Department's OAS-developed drone training curriculum FAA Pilot Written Exam equivalency and the Department's test questions served as a foundation of the FAA regulations for commercial use of small drones.

OAS leveraged approximately \$25 million in excess military drone equipment to conduct hundreds of test and evaluation flights. Following rigorous testing, the Department now manages a fleet of 393 aircraft, flown by more than 300 certified pilots including 80 fire-qualified pilots. In May, the Department awarded a contract for four fire-specific, call-when-needed vendors with 5 different airplanes. This means that there are aircraft and pilots available to support the fire community across the country.

This past fire year, the Department conducted 707 drone missions on 71 individual wildfires. Drones were used by firefighters to gain a tactical advantage on wildfires by allowing them to improve their surveillance and reconnaissance capabilities. A great example of that is the North Umpqua Fire in Oregon in 2017, when a drone operator wrapping up a reconnaissance flight noticed an undetected hotspot. They were able to contain the hotspot right away, thus preventing a fire escape having the potential for more than \$50 million in resource and property damages.

Drone flights, including support to firefighters suppressing wildfires, increased 82 percent from 2016 to 2017. In the first quarter of 2018, we have seen a ten-fold increase compared to the first quarter from 2017: a jump from 175 flights to 1,753 flights. The Department's drones flew on every hurricane impacting the U.S. in 2017 and are currently operating in Hawaii to support the volcano emergency. Interior drones have worked on wildfires, conducted wildlife and habitat surveys, assisted with dam inspections, and supported search and rescue efforts.

OWF is constantly looking at new technologies including cell phone-based applications and alert systems that improve firefighter safety. In conjunction with the Department of the Defense, we are looking at UAS-based command and control systems that provide cost effective monitoring and planning support for fire operations. This approach could make novel use of existing technology. In the near future we could see tactical drones providing real time information for the duration of suppression operations using applications downloaded to cell phones that are already in the pockets of every firefighter.

Veterans

United States military veterans are an invaluable segment of the Department's labor force. While they offer their remarkable work ethic, leadership, and integrity at all levels of the Department,

veterans' contributions are most apparent in the ranks of our wildland firefighting forces. We feel a deep responsibility and commitment to continue hiring veterans to fill these positions.

The Department recognizes that our veterans have unique challenges after separating from the military. That sentiment is shared by Team Rubicon, a partner organization which was founded by military veterans in search of a way to continue their service. Through collaboration with Team Rubicon, the BLM has provided Wildland Firefighter Type I and II training and certification, along with a refresher course, for over 700 veterans. The immense success of this partnership has necessitated additional and advanced courses, such as helicopter crew member training, basic timber faller training, and expanded dispatch training, as well as an added training location to make certification more accessible. Since the partnership's inception in 2015, over \$1.8 million has been provided for training and fire assignments, and in 2017 alone, veterans were dispatched on over 120 incidents.

In addition to the Department's partnership with Team Rubicon, the BLM has constructed fire crews specifically to employ veterans. The BLM currently hosts eight Veteran Fire Crews operating out of seven states: Arizona, California, Montana, Nevada, Oregon, Washington, and Wyoming. We are grateful to have these dedicated men and women in our wildland fire community, and we remain committed to our partnership with Team Rubicon.

Conclusion

This concludes my statement. Thank you for your support of the Department's WFM program and for the opportunity to testify before this Committee. I welcome any questions you may have.

The CHAIRMAN. Thank you, Mr. Rupert.
Thank you both.

Let me begin with the questions here. I appreciate that both of you have addressed the issue of workforce misconduct, harassment, and what you are doing to bring about the very, very necessary changes to rid the agencies of sexual harassment and all forms of workplace misconduct.

Ms. Christiansen, you mentioned that you have a code of conduct that has been introduced and mandatory training. Mr. Rupert, you have also indicated that you have a new anti-harassment policy and you reference that this training includes those that are on the fire line.

Chief Christiansen, regarding the outreach for the training and this full-day session that you referenced, does this also include those within the firefighting ranks? Is this only for people within your administrative offices? Who are we covering here and what is the extent of these new policies that have been put in place?

Ms. CHRISTIANSEN. Yeah, thank you very much, Senator.

Yes, it is for every one of our permanent and seasonal employees. That's why we waited until the second week of June—the majority of our seasonal staff are onboarded now. So, this is, we are, you know, shutting down a business for one day, rolling each week in different units, one day, to focus on this training and the importance of breaking the silence and what it is really going to take to shift our culture sustainably.

We started with listen and learn sessions across our whole organization. Now that did not include as many of our seasonals, but that really was—we needed to demonstrate as leaders what was really being felt in the workforce. That really fueled the design for our Stand Up for Each Other days next week.

And we, about 18 months ago, passed a very broad, anti-harassment policy. And we've been working on this agency specific training with real agency examples, with real employees on a—we've recorded our own training. And there will be discussions in every work group across our organization, administrative staff, field staff, fire staff, the headquarter staff. Each work unit will identify what they need to make commitments to each other to improve the work environment.

But that, you know, we've started with an enhanced reporting center. We opened that up in the Fall of '17 so that the fear of retaliation, we're trying to minimize the fear of retaliation. We want to hear if anyone has any concern. We've seen increased reporting.

The CHAIRMAN. What action, then, is taken if it is reported and this is a situation out in the field. You have an active fire underway. People are working.

How do you enforce this because it is nice to be able to say that we have a one-day training session and then you go out there for the season, but it is not like you are reporting to somebody in an office back here? I think this has been one of the very significant concerns is that out in the field it is a different environment.

Ms. CHRISTIANSEN. Yes.

The CHAIRMAN. And that there is more that is "accepted."

Ms. CHRISTIANSEN. You're absolutely right. That's about getting under what's in our culture.

So there's both—being very clear about what is not accepted and changing those behaviors, and then there are structural things that will allow reporting in different ways. So, even if you're out in the field, if there is cell service, a 1-800 number, 24/7, will pick up that someone that has a complaint can report it to and then we have timelines. Action must be taken within 24 hours to look into an investigation and to evaluate the situation and to take corrective action.

The CHAIRMAN. Mr. Rupert, very quickly on DOI side. Do you have a similar process then for reporting and required action?

Mr. RUPERT. Yeah, the policy that was recently put in place in DOI sets very rigid expectations for managers and supervisors and timelines to respond to complaints. And so, there's a tremendous focus on ensuring that that process, that really explores and understands and, you know, provides that inquiry and investigation it's rigid in expectations, go along with it, to follow through.

I think to the point of, you know, in the field, especially in these areas, these incidents where we have very, sort of, diverse organizations that are all contributing as both of our departments, I think, have started to put in much more rigid expectations for how behaviors, inappropriate behavior, be treated with that we're anticipating that that will generate more interaction when these things occur.

We've had dialogue at senior management level, not only between Interior and Ag but also with our partners across the entire community, the states, local organizations, tribes, in those inter-agency settings to ensure that these incidents occurring—where this occurs on these incidents where we have this real diverse, sort of, community, all working together, that we don't lose track of those complaints and that we are following those back to the home organization to, essentially, ensure that the people are being held responsible for their behavior.

The CHAIRMAN. Well, I know that from an oversight perspective, we will be back to you on this to make sure, again, that this is more than a one-day training, that this really is about changing a culture that has been allowed to take over our agencies, that has been an extraordinarily black mark. We need to correct that. You know that, and we want to keep monitoring this.

Senator Cantwell.

Senator CANTWELL. Thank you, Madam Chair.

Chief Christiansen and Mr. Rupert, we were all together at the Department of Agriculture to discuss this MOU between the Department of the Interior and the Forest Service, and I saw that last week the Department of the Interior awarded four contracts to companies who operate medium-sized, unmanned aerial vehicles for wildfires.

I'm proud to say that one of those was Insitu from Southwest Washington and Northeast Oregon, a company that spans the Columbia, literally the company is on both sides, and we are so proud of that technology.

But most importantly, we are proud that Interior is being very aggressive about using this tool on wildland fires. We want to make sure that there is now no barriers between the Forest Service and Interior working together to implement this. This is so critical

for information about fire size, starts, and the safety and security of our firefighters.

So, is there anything that is holding us up from being very aggressive about this deployment during this fire season? Do you have to do anything else to make sure that these tools are now used across agencies or implemented?

Ms. CHRISTIANSEN. Senator Cantwell, thank you for that question.

And I'm, you know, I'm pleased to say that this is an example of that we're really coordinating together.

The Forest Service is clearly looking to the early adopters and the innovation that DOI has really stepped out on and we applaud that, instead of us spending the dollars and the time to do the innovation and the testing that they've done.

We are absolutely committed. We are drafting on them, if I might say, with our policies, our procedures, to make sure that we have interoperability so that we don't have policies and procedures that are different.

The Office of Aviation Services at DOI has been extremely helpful in our policies and procedures. They have done train-the-trainer for our staff, and we can access their call-when-needed contracts at any time, as well as the states and others.

So, we are not ashamed to say that we applaud our Department of the Interior colleagues, and we also see a very strong use and innovation and safety aspects of using UASs on fires. I look forward to when they can have additional capacity beyond just the surveillance.

Senator CANTWELL. Thank you.

Anything else, Mr. Rupert?

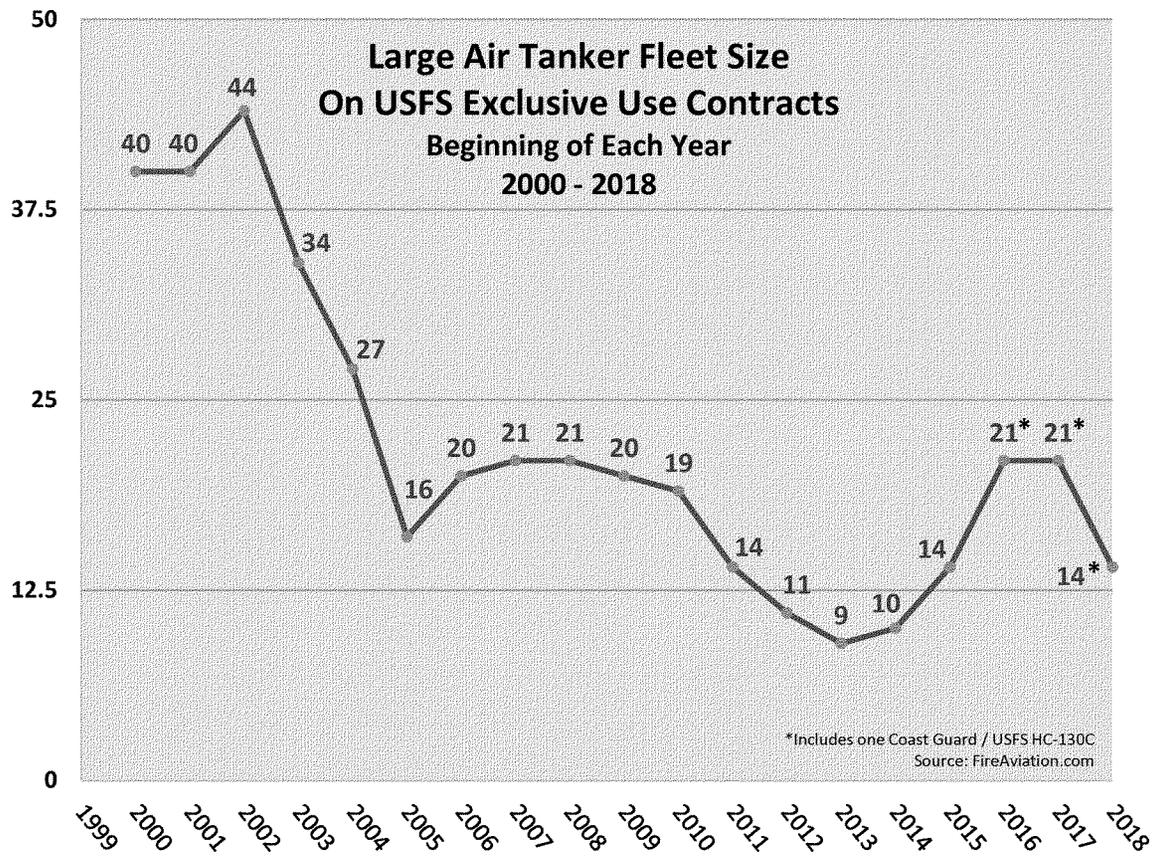
Mr. RUPERT. Well, thank you for the recognition and thank you, Vicki, too.

I would just say the easy answer to the question is yes, the call-when-needed UAS contract is available, not only to the Forest Service, but it's being administered as a national asset the way we administer other national assets. So, it's available across, really, the community on those large incidents—

Senator CANTWELL. Well, I assure you we are going to need them, so thank you.

On call-when-needed, the air tanker issue.

[The information referred to follows:]



Senator CANTWELL. I am concerned that we are shifting 35 percent of the current air tanker contracts to call-when-needed. We had a chance to talk about this before, Chief Christiansen, about the fact that call-when-needed contracts are more expensive per day but yet, I think, to get the planes you are going to have to call them every day and say you are on call. What I am trying to understand is how we are going to supplant that for the panoply of resources that you could have. So, I am just trying to understand.

Is this about going deep where the resource is from a budgeting perspective or do you truly believe that call-when-needed, as it relates to these services, is the most cost-effective way for taxpayers?

Ms. CHRISTIANSEN. That's a really good question and we, as I said earlier, will monitor closely that balance between the upfront expenditures we use for exclusive-use and how much we actually need them versus the yes, more expensive, but we pay for them when we use them, call-when-needed. It is an art and a science, and the science part is informed looking backward, and we have to look forward.

To be honest with you, Senator, we would like to rebalance in the incoming years. We think that we need to have a little bit more balance between exclusive-use and call-when-needed.

We were in transition this year, quite frankly, from getting the legacies off contract because that contract is done, and this is a transition year.

Senator CANTWELL. Well, I so appreciate you saying that because I want you to have every single tool you need.

Ms. CHRISTIANSEN. Yes.

Senator CANTWELL. I want you to have air tankers. I know that you had one acquired from the Department of Defense and am not sure if you are going to use it. I want you to have these water scoopers. I want you to have the large retardant planes. I want you to have every single asset.

So I hope that you will, given what you just said, work with us to figure out how to make this not a transitional season here but a season where you have every tool at your disposal. That is what people in the West want us to be doing. They want us to be giving them every tool possible to fight this fire season.

So, thank you.

Ms. CHRISTIANSEN. Thank you.

The CHAIRMAN. Thank you, Senator Cantwell.

Senator BARRASSO.

Senator BARRASSO. Thank you very much, Madam Chairman. Ms. Christiansen, Mr. Rupert, thanks so much for being with us today.

A couple of questions.

The National Interagency Fire Center's outlook for the summer of 2018 largely contained positive news for Wyoming. We all know how quickly on the ground conditions can change.

Across Wyoming we have had above-average snow pack and spring runoff which has contributed to, what has been labeled as below level, below normal fire potential. But higher precipitation, as you know, can often mean rapid grass growth. It can dry and by August we have trouble.

So talking to our Wyoming State Forester, Bill Crapser, he has his rule of sixes and he said it just seems about every six years, and 2018 is the sixth year. But Wyoming is going to see fire this year and questions remain about forest health, effective use of resources, improving coordination among agency partners, and how we can best do that.

And a lot of it comes down to the millions of acres of the ecosystem across the West affected by pine beetle, bark beetles, you know, we have had, we are no stranger to die offs than you are not either, of these standing dead trees which continue to pose significant threats. You both identified the need to reduce hazardous fuels. Both agencies have tools to take preventive action, including those provided in the recent FY2018 Omnibus funding bill.

So, in places like Wyoming where a lower intensity fire season is expected but it may happen otherwise, do your agencies have the flexibility that you need to take advantage of certain years and adapt fuels treatments as the year goes on in real time to increase preventive measures to, kind of, get ahead of the curve in terms of all this standing fuel?

Ms. CHRISTIANSEN. Senator, thank you for that really good question.

And I don't mean to burst your bubble, but the white on the map that Senator Cantwell put up doesn't mean it's below normal, it means it normal conditions.

Senator BARRASSO. Yes.

Ms. CHRISTIANSEN. So that indicates we still will see fires on the white part.

Senator BARRASSO. Yes, my point, yes.

Ms. CHRISTIANSEN. But yes, you don't have as much red in Wyoming. So you're exactly right. We have to use every tool in the toolbox for treating these hazardous fuels, that is mechanical treatments, but it is also using fire when we are in control of fire because fire will help reduce fuel loads in many of these ecosystems and sometimes they need both.

When we have more favorable conditions, we need to take advantage of those operating windows, both on fire severity and smoke management.

And we heard very good comments by Senator Cantwell in her opening statement about we are working with the public on how we take our smoke under terms that we, none of us, care for versus terms that are going to improve conditions.

We just had a two-hour call with all of our leadership across the country about how we deploy resources, not only for fires, for wild-fire response, but for hazardous fuel and other important treatments. We're on that and states are a critical part of that discussion as well.

Senator BARRASSO. Thank you.

Mr. Rupert, you feel you have the flexibility?

Mr. RUPERT. Yeah, so, for Interior a lot of the—so, the efficiencies, for example, in the Omnibus, largely were focused on forest authorities. And so, we're largely still operating in the framework that we have operated in in Interior in terms of planning, projects, and then ultimately working to put them on the ground.

We're very much focused in Interior on streamlining those existing, that existing, framework and that existing process and we're making good headway there.

So, ultimately, projects, there is an aspect of projects needing to have that planning to help drive them. We're still very much doing that.

By the same token, conditions on the ground, in addition to values that are at risk and their exposure, potential exposure, to wildfire. Yeah, weather conditions and having the right conditions to be able to get in there and do proactive vegetation management is very much a part of the equation year-to-year, season-to-season.

Senator BARRASSO. Great, thank you.

Ms. Christiansen, the Black Hills National Forest formed a number of years ago an advisory board to provide advice and information to the forest supervisor from the various stakeholders. The board is currently experiencing a number of vacancies and the nominations have to be approved by the Secretary, so it takes some time. Without approval of pending nominations, the March, April, and May meetings have all had to be canceled because there are not enough members. The board is planning to meet again in June, but again, with this many vacancies, that meeting is going to have to be canceled. Do you have an update on the situation and the nominations?

Ms. CHRISTIANSEN. Senator Barrasso, we clearly hear the concern and we, too, are making this a priority to get the willing nominations in and have the vetting done and working very closely with the Secretary's office.

He, I know, is also committed because being a good neighbor is having everyone at the table to have a voice in how their lands are managed. So, it's a priority for us.

Senator BARRASSO. Thank you very much.

Thank you, Madam Chairman.

The CHAIRMAN. Thank you, Senator Barrasso.

Senator Wyden.

Senator WYDEN. Thank you, Madam Chair, and thank you, Madam Chair and Senator Cantwell, for your leadership.

We, of course, have the fire-borrowing language on the books. I think that is going to be helpful for the long-term.

Ms. Christiansen, we look forward to getting the plan at the end of June on how you are going to deal with the backlog on hazardous fuels reduction. That is what we talked about here in this Committee.

I very much appreciated the fact that you have been in discussions with us about how you are going to be attacking that, and I look forward to that as well. I think the country very much wants to know what the game plan is for reducing those hazardous fuels.

Sometimes it feels like all of us as individual Senators are running weather bureaus because our citizens are so concerned about this. For the country, May is the ominous month for the fire season. It traditionally gives you a sense of where things are, and like many of my colleagues, it looks like we are going to have some real challenges in Oregon this summer.

By the way, our friend, Senator Heinrich, is exhibit A for this proposition. The reason he is not with us today is because he is in

New Mexico where he is dealing with a wildfire. So this is not some kind of abstract theory.

So, let me, if I might, talk to you about this air tanker issue. In my state, as is the case in many places, they felt they didn't have enough tankers last summer. So I think a lot of people are going to listen to this and say, well, they are playing a shell game back in DC. They are going to have this kind of tanker. They are going to have that kind of tanker. I know that is not your intention.

So, let me ask it this way. You've got this plan. Let's say there are not enough tankers, period. Lives are on the line, lives that sometimes can be affected by hours, not even days. What do you do in that kind of situation?

Ms. CHRISTIANSEN. Well, Senator, you know, we really appreciate the concern of the citizens, and I would be delighted if we could have a little window into the intelligence, the predictive services, and the 24-hour decision-making that is done at the geographical area and at the national area.

So when we are in those high preparedness levels, we call them preparedness levels 4 and 5, where nationally we have to prioritize the resources. Each geographic area, and for Senator Cantwell and you it's the Pacific Northwest geographical area, the executives and their key fire leadership are meeting hourly and updating the situation and that feeds into the National Interagency Fire Center where the national group of all of our representatives——

Senator WYDEN. Can I stop you right there?

Ms. CHRISTIANSEN. Sure.

Senator WYDEN. Because I think that is very constructive, and it is also in English because so much of what goes on in fire is hard to comprehend by people.

I believe what you have just said is you use your predictive services and then on an ongoing basis, really hourly, are able to deploy the assets you have. What if you don't have enough assets?

Ms. CHRISTIANSEN. Yes.

Senator WYDEN. In other words, you make a judgment that you just don't have enough assets which has been the case over the years where even the best people's intentions...

Ms. CHRISTIANSEN. Right.

Senator WYDEN. But you don't have enough assets. What do you do then?

Ms. CHRISTIANSEN. Yes.

So, it's a prioritization. That's what I was getting to. It's a tiered prioritization. First are the most critical threats to humans and communities, then generally, critical watersheds and the like. Then we do have additional surge capacity that we can bring on.

Senator WYDEN. Where does the surge capacity come from? Are these just tankers that are somewhere else?

Ms. CHRISTIANSEN. Yes.

Senator WYDEN. That are not part of the two categories you told Senator Cantwell about, that this is, kind of, a third category.

Ms. CHRISTIANSEN. Yes.

Senator WYDEN. Surge category that you can bring in if you just don't have enough.

Ms. CHRISTIANSEN. Yes.

Senator WYDEN. Where do they come from?

Ms. CHRISTIANSEN. The Department of Defense, the mobile aviation units, the modular units.

Senator WYDEN. How many of them are there?

Ms. CHRISTIANSEN. We have seven? Yes, seven, seven of those and then generally, by the time we are in the significant part of the fire year, we say fire year in the West, we can bring our partners down from Canada, our two additional surge capacities.

And then we are putting out additional calls when needed and later in the summer we anticipate having at least five more on call when needed, so up to 30.

Senator WYDEN. I am over my time.

I just want to close by saying I think you are working very hard at this, and you are playing offense and that is really the key.

I would just like it if you could also furnish to the Committee, through Senator Murkowski and Senator Cantwell, a written answer to what I just asked about when there are not enough tankers. I had never really heard a whole lot about this, sort of, surge capacity group of tankers and I knew a little bit about Defense. When I was Chair of the Committee, Senator Murkowski and I used to talk about this. So, if you could get that to us in writing?

Ms. CHRISTIANSEN. Sure.

Senator WYDEN. But I want it understood, I think you are working very hard at this. Your relations, with keeping us informed, have been very constructive, and we appreciate it.

Thank you, Madam Chair.

Ms. CHRISTIANSEN. Thank you.

Senator CANTWELL. If I could just—

The CHAIRMAN. Senator Cantwell.

Senator CANTWELL. —15 seconds?

I want to make sure that NASA is the partner you want on those fire weather updates. Okay? We want to make sure NASA is giving you the satellite information you need on an hourly basis.

Thank you.

Ms. CHRISTIANSEN. Absolutely, we are working with NASA.

The CHAIRMAN. Thank you both.

Senator Daines.

Senator DAINES. Thank you, Chair Murkowski.

Chief Christiansen, good to see you again here before this Committee.

Last fire season in Montana, nearly 1.4 million acres burned. When you break that down to national forest, it is 680,000 acres. We were left with a great deal of dead and dying timber which causes serious public safety risks, yet we see significant delays associated with completing NEPA analyses of these burned areas and they prevent the salvage and other long-term, post-fire restoration work from being completed in a timely manner.

I have to say, Montanans scratch their heads. They say, we can't even get into burned areas here to salvage that timber. And, of course, we all know that clock is ticking when it is still salvageable.

Chief Christiansen, I have heard from many Montanans who want the Forest Service to use your Emergency Situation Determination (ESD) authority to get more post-fire work done sooner. As you know, I encouraged you to approve these ESD requests for

the fires in Montana last year. Could you provide an update on my request for these ESD approvals?

Ms. CHRISTIANSEN. Thank you, Senator Daines.

I have to say I'm quite pleased with our staff in Montana. They activated quickly. We put together strike teams to work on the salvage, worked with the communities and with industry on what would be the ideal place that industry could receive this salvaged material. Using the Emergency Situation Determination is a very important tool for both health and safety and for the imminent threat of the product declining rapidly.

I have signed the first one of those. I expect the Sunrise Project on the Lolo National Forest, I signed last week. Regional Forester Martin knows what I expect to see for my confidence to sign the next four, and I'll have those within the next two weeks.

Senator DAINES. That is refreshing and it is very good to hear, Chief.

Given the sometimes-lengthy approval process and time with ESDs, what can Congress do to encourage faster and more extensive use of this tool by the agency?

Ms. CHRISTIANSEN. Thank you, Senator.

You know, I think it's just understanding the process and the balance. Obviously, we take this tool very seriously, but we need to not abuse it. We want to be strategic and really look for the areas where health and safety or critical decline in the product are in place.

So, working, you know, your voice and the communities that we'd like their early involvement in the scoping so we can move out quickly. So, you know, we do this in a transparent way with communities and citizens that care. Your help in getting communities to work with us quickly, I think, will help down the line, and your continued support of the tool that we can sustain it and uphold it as it was intended to be used.

Senator DAINES. Thank you, Chief.

Mr. Rupert, could you discuss the economic as well as the environmental benefits of carrying out restoration efforts as quickly as possible following large fires on DOI lands?

Mr. RUPERT. Sure.

I think, so restoration, you know, just to, sort of, identify that as being slightly different than how we would approach say, emergency stabilization which happens immediately after the fire. So, restoration rehabilitation as we get into that, I think, in a lot of ways it's location, location, location. There are many areas around the country where getting in there immediately. And this is, you know, so this is, sort of, it's a local stakeholder driven need that I think we have here. There's some places where getting in there immediately getting work on the ground, immediately getting trees replanted absolutely makes the most sense to get it back to, sort of, a healthy state that is economically supportive.

There are other parts of the country where, quite frankly, we probably don't want to get in there immediately because the conditions that are going to really lead to successful restoration may not be in place until later in the year or a different season or after we have rain. I mean, a whole, just a variety of different circumstances.

So, I think, it sort of depends based on location, but there are absolutely many examples where the faster we can do it, the faster we can get in there, the better.

Senator DAINES. Chief, could you address what impact litigation has on the region's ability to meet its timber and restoration targets?

Ms. CHRISTIANSEN. Yeah. Litigation clearly takes focus away from getting our work done. It prevents the critical restoration to create the fire resiliency that we all are trying to achieve and it, quite frankly, gives pause to our staffs to be pretty risk averse.

So if we could work with folks early in the collaborative process, if everyone would come to the table, we are always willing to hear everyone and to work it out, but litigation on the back end really slows down the important critical work that we're trying to do.

Senator DAINES. It is awfully expensive too.

Ms. CHRISTIANSEN. Yup.

Senator DAINES. Wrapping up, Chief, as you know, the most recent forecasts from the National Interagency Fire Center predicts above-normal fire potential for Montana. I just saw your chart, and took a quick picture of it. It was sitting there for a moment. Oh, there it goes.

Here we are in Montana experiencing snow packs well above average with flooding in many parts across our state. As you mentioned to us in our briefing here a few weeks ago, there are a lot of variables that go into that outlook, but it looks like we need to buckle up for what looks to be another tough fire season.

Congress recently provided new authorities to the Forest Service but much more needs to be done to address the significant threats of wildfire. I look forward to working with you to build additional support for some of these litigation protections and reductions in red tape so restoration projects can get done sooner.

Thank you.

Ms. CHRISTIANSEN. Thank you.

Senator CANTWELL [presiding]. Senator Cortez Masto.

Senator CORTEZ MASTO. Thank you.

Thank you, Ranking Member, and thank you both for being here.

Let me initially just associate myself with the comments the Chair made with respect to sexual harassment and addressing that issue in both of your agencies.

Ms. Christiansen, I could not agree with you more. It is a cultural change, so we have to be vigilant and constant and we have to have policies and procedures in place. I look forward to working with you, supporting you, and making sure we are constantly addressing this issue.

Let me talk about Lake Tahoe. Lake Tahoe is important for both Nevada and California. And I know, Ms. Christiansen, this is an issue that we have talked about in the past. Over 74 percent of the area around Lake Tahoe is public land managed by the Forest Service, and after decades of fire suppression, the Tahoe Basin's overstocked forests are highly vulnerable to insect, disease, and catastrophic wildfires. They lack the diversity in age, structure, and species distributions to support a healthy forest ecosystem. Forest management projects are essential to the safety of Tahoe's communities and the health of its forests. The threat of a cata-

strophic wildfire at Lake Tahoe is a top concern for the entire community in both states.

So with the increasing outlook for above-normal, significant wildland fire potential in Northwestern Nevada, as we can see from the maps, what precautions is USFS undertaking to safeguard this area in particular?

Ms. CHRISTIANSEN. Thank you, Senator.

Let me just make one quick comment on work environment. It's not a one-day training and we're done. This is a starting point of a long journey.

Senator CORTEZ MASTO. Thank you.

Ms. CHRISTIANSEN. In regards to Lake Tahoe, it's an emblem of a community at high risk with high populations and it is a good example of a community that is working across boundaries together.

I hate to say this, but it's working way up front of any fire that's in sometimes several years of working across boundaries on both getting the resiliency of the lands in better shape, as you suggested, and the communities prepared to have fire, being fire adapted.

The tools added to the Farm Bill tools, from 2012 to what was just recently passed in the Omnibus, are a great step forward for us to be able to move more swiftly to get more done and to stabilize—when the fire funding fix goes into effect—our operating environments so we can do the investments on the ground.

Additionally, the reforms we're doing ourselves, internally, will help us to get more work done. I'm proud of the 36 percent increase in the work across these lands and that means with Interior, and with our state and local partners.

So, the principles of what we call the National Wildland Fire Cohesive Strategy, where we need to create the resilient landscapes, fire adapted communities, and have an effective risk space response to fire.

I know I have an invitation, and I want to get out, to Lake Tahoe. I was there a couple years ago, and it is a great example. You have some great leadership of working across boundaries.

Senator CORTEZ MASTO. Thank you.

We appreciate you being participants and the focus on that area because it is an area where both of the Senators from California and Nevada have come together—

Ms. CHRISTIANSEN. Yes.

Senator CORTEZ MASTO. —with the local community to really address this issue. So we appreciate you being there.

Let me jump back to the top of the conversation that Senator Cantwell talked about which is haze. I do not think people realize that when there are fires going on in the Northwest, and in a particular state, it is not just addressing and impacting that state. If there are fires in California, we see the smoke and the haze in Southern Nevada or Reno. So it has an impact on the region.

For that reason, I am curious . . . what is it that you look to to address the health effects when it comes to that haze and the issues affiliated with any type of a wildfire? Let me bring this up because I know you have an Office of Environmental Health that studies

the events and their impacts on people's health, in particular, but my understanding is that is being defunded. Is that correct?

Ms. CHRISTIANSEN. From—where?

Senator CORTEZ MASTO. Office of Environmental Health?

Ms. CHRISTIANSEN. I'm—

Senator CORTEZ MASTO. Is that not true?

Ms. CHRISTIANSEN. I'm sorry, I'm not familiar—

Senator CORTEZ MASTO. With that?

Ms. CHRISTIANSEN. No.

Senator CORTEZ MASTO. Okay.

Ms. CHRISTIANSEN. I can speak to a partnership that we, the Greater Wildland Fire Community, we've entered into with the Center for Disease Control and they're really helping us study both the fuel type from prescribed fire and wildfire and the time of year and to not only show that the quantity of smoke is different, as Senator Cantwell expressed in this report, but the type of the particulate matter, looking that closely at the particulate matter between wildfire smoke and prescribed fire smoke.

We're really pleased that we have such a solid partnership with the Center for Disease Control because that's going to really accelerate us having the public conversation about how we handle smoke.

Senator CORTEZ MASTO. Thank you.

I know the Department I was talking about is in Interior.

Mr. Rupert, do you have any comments?

Mr. RUPERT. Yeah, so I'm not familiar with this and I'm happy to look more specifically into and give you a good response to that particular question about that office.

I would just say that as we look, sort of, where we're at now and where, sort of, where we want to go in the future to start to deal with this issue, there's lots of interaction between the wildland fire community and air managers, EPA, and others. Essentially, I think, the shared vision here is that we're much better off under a prescribed-fire scenario where we control the circumstances and the volumes and the character of the smoke that's in the air as opposed to catastrophic, uncontrolled wildfire where we have no control whatsoever. We're stuck with it.

Senator CORTEZ MASTO. I agree.

Thank you. Thank you both.

The CHAIRMAN [presiding]. Thank you, Senator.

Let me ask about the vegetation management provisions that we included in the Omnibus. Chief, can you give me, kind of, a status report on the implementation of these provisions that we included?

I think we recognize that when we are thinking about the physical integrity of transmission and distribution infrastructure, this is key to protecting the security and reliability of our energy grid when we are talking about a wildfire. So give me a quick update here.

Ms. CHRISTIANSEN. Certainly, Senator.

We have moved swiftly. We have done the full analysis of these provisions, and we've given really specific direction to our regions.

As you know, they'll be submitting to us their plans by the end of this week on the utility right-of-way. Vegetation management, that's more opportunistic. I've asked every one of our regional for-

esters to describe how they're prepared to meet the response times that those utilities will require so that we can be timely in allowing the vegetation management projects to move forward. It's basically direction to our region to be ready and show us how they are prioritizing when those requests come in from the utilities and to work with them in advance to know what that workload is going to look like.

The CHAIRMAN. Okay.

Mr. Rupert, are the folks at BLM and Forest Service coordinating on this implementation effort?

Mr. RUPERT. Excuse me, thank you.

There's been very active, ongoing engagement and coordination looking at coming up with consistent approaches to this. BLM is well into the process and is very close to releasing an IM, informational memorandum, which is a policy essentially reinforcing side boards, timelines, and expectations for implementation.

The CHAIRMAN. Okay, good, good.

There has been discussion already with regards to the unmanned aerial systems. How does DOI and the Office of Wildland Fire coordinate with Forest Service in terms of the drone program?

Do you both operate them separately and is there some level of communication or coordination that goes on with these assets?

Mr. RUPERT. Well, sure. Maybe I'll start.

In Interior, UAS drone operations aren't strictly wildfire. In fact, the majority of the drone missions that are flown in Interior are actually resource missions—surveys and inspections.

In the case of wildfire though, we have a fleet. I think we're approaching 500 DOI-owned drones, and we have several hundred certified operators. Many of those operators are qualified then to operate on a wildland fire incident.

As you know, the coordination that occurs with that wildfire focus is really similar in terms of establishing those interoperable standards that allow us to go into these incidents, that we know we have certified, qualified operators that are capable of piloting these drones in that environment to support the incident response.

In a lot of ways it's very similar to how we coordinate all other assets in the wildland fire world. I think that's been one of the really successful parts of this drone implementation is that we really have taken that wildland fire community-wide sort of implementation standard, interoperable approach.

The CHAIRMAN. Do we have any sense as to the savings that we might be able to obtain by using drones? Obviously, from a safety perspective, I mean, it is clear there. But in terms of using the traditional aircraft versus drones for some of the more traditional wildfire tasks. Do we have a sense as to what that cost savings might be?

Ms. CHRISTIANSEN. We don't have specific dollar figures, Senator, but like any buildup investment, we imagine what we can get to.

As Mr. Rupert says in both a resource end of things, you know, the forest health detections that we do across this nation, when we can get that to having drones instead of the aerial surveys, then it's in the magnitudes of tens that the potential savings is, but we're in that innovative stage to how far we are going to be able

to go replacing people with the cameras. We imagine it can be great, and we're going to incrementally work ourselves there.

The CHAIRMAN. Let me ask a little bit about that. I was up in South Central Alaska and I was struck by the amount of spruce bark beetle kill that we are seeing up beyond the Mat-Su Valley, up toward Denali. It is an area that I had not really noticed the kill.

Obviously, the Kenai Peninsula was decimated some years back and, unfortunately, we are seeing some evidence of that again and this is done through the aerial surveillance, but we are seeing evidence that the beetle may be back.

It is my understanding the spruce bark beetle has already decimated over 1.3 million acres, more than 30 million spruce trees on the Kenai Peninsula alone. Again we pay very, very close attention to this because of the potential for increased fire threat, particularly down on the Kenai Peninsula right now.

But it is not just the Kenai Peninsula. I was looking at my clips this morning and just in this morning's newspapers around the state we had a fire down in Gustavus, of all places. This is in the Tongass National Forest.

Ms. CHRISTIANSEN. Yes.

The CHAIRMAN. One up in Talkeetna this morning, a small one, and then the first big fire up in Interior, off of Rosie Creek Road which is just up from the area where I grew up.

It is fire season for us. I know that we are projected to have a normal year, but for us, normal is still over, oftentimes, one million acres. So this is something that we watch with great, great interest.

What are the agencies doing to work together, again, not just within DOI and Forest Service, but working with the state, as we are dealing with some of the beetle kill issues and, again, this resurgence that we are seeing whether it is down on the Kenai or whether it is now moving more into South Central and into Interior?

Ms. CHRISTIANSEN. Senator, the recent aerial detection survey in 2017, there were 27 million acres flown in Alaska and there were over 840,000 acres that was recorded forest damage.

You're correct, it's in South Central. There was over 400,000 in this recent survey, largely in the Susitna Valley, in that area, as you described.

It's across all lands, so we are working collectively. We have put together a Spruce Beetle Working Group, research group, in Alaska with the Division of Forestry and the Alaskan—

The CHAIRMAN. Now, as I understand that that task force was focused on the Kenai Peninsula. Are you expanding this to a broader area in the Susitna region or the Mat-Su region as well?

Ms. CHRISTIANSEN. Yes.

The CHAIRMAN. Okay.

Ms. CHRISTIANSEN. That's my understanding.

And you know, there's a spruce beetle website stood up and we've also awarded special technology development grant to develop Landsat methods for having a broader look, both spatially and temporally at the detecting both the past and the present disturbances

across Alaska. This will help us monitor the insects and disease activity on a larger scale, kind of, let us get behind this.

We are working in Southeast Alaska, the largest area, where there are smaller pockets of spruce beetle activity, but the largest area is in Glacier Bay National Park. So our Forest Health Protection Program is collaborating with park staff about monitoring and traps this summer. We are clearly working across boundaries in the park as well.

The CHAIRMAN. Well, as we all know, and it is not just in Alaska, where we have the beetle kill, it has been raised by other colleagues.

So, again, making sure that these forest management tools that we provided you in the Omnibus to really do more when it comes to, whether it is the thinning, the prescribed burning, just every effort that we can do to reduce that fire risk, but also really working to address the management reforms that we all believe are critically important, as I know you do as well.

We have one more vote and thus the absence of other colleagues here this morning, but if folks do have questions for the record, we will make sure that they come to your attention and would ask that you respond to their concerns as well.

I do want to ask one more question and this relates to the Roadless Rule there in the Tongass. You know my position on it. I have always said I did not think that the Roadless Rule made any sense in a place where it is an area that is just made up of islands, 32 island communities.

As we are looking for access within the Tongass, the big focus has been, of course, on the limitations that are provided by the Roadless Rule. You have a petition from the State of Alaska that asks for that exemption from the Roadless in the Tongass.

Last time you were here we had a conversation about this and the Forest Service plans. Can you give me an update on the status of the State's petition and when the Forest Service might act on that petition?

Ms. CHRISTIANSEN. Thank you, Senator, absolutely, I can.

Senator or excuse me, Secretary Perdue and Governor Walker just spoke on Friday, this past Friday, June 1st. They agreed to pursue a state-specific Roadless Rule to address the concerns as swiftly as possible on the Tongass National Forest and the access for timber, energy development, and many other forms of access on the Tongass. We are working closely with the state to align the resources, to get started immediately. We, the Forest Service, have identified funding and actually the resources in people and staffing and expertise to get started. We're in close contact with the state, and we'll be glad to keep you up to date.

The CHAIRMAN. I appreciate that and perhaps what we need, might, want to do is schedule a meeting with yourself and the Secretary, if he is available, to further discuss this matter.

I am cognizant that with the state petition (my good friend, Senator Risch from Idaho, was one that led that in his state and he has made clear to me that this is not an easy process), it is not a quick process, and it is not a cheap process. Making sure that there is a good understanding as to what this process is, basically moving forward with the State's petition, is how that is clearly out-

lined. It is certainly my hope that whichever, whatever, that process looks like it does not result in anything that is less than a full exemption from the Roadless for the Tongass.

I would like to be able to speak with both you and the Secretary about that petition—but again, understanding how we can move forward in a way that does acknowledge the reality of the situation that we face within the Tongass. I look forward to more discussion on that.

With that, I think, as I am looking through this, maybe this question was asked when I was out on the vote, but have you provided the status on the aerial firefighting use and effectiveness study? That was back in 2012. It is my understanding that the agency launched this use and effectiveness study five years ago. It is also my understanding that we really have not seen any information that has been released from that work which does not make any sense. That is not acceptable if we have requested it and five years later we still have not seen that release. Again, I do not know if you have addressed this already and if you have, I apologize, but can you just tell me where we are with that?

Ms. CHRISTIANSEN. Certainly, Senator. And no, I have not addressed it yet.

The CHAIRMAN. Okay.

Ms. CHRISTIANSEN. As you know, that's a study to look over a variety of different fire situations, the use and effectiveness. Are we using it appropriately?

The CHAIRMAN. Right.

Ms. CHRISTIANSEN. And how effective is retardant?

This is a major investment. Retardant is a critical tool, but we want to know if we're using it correctly. And like all studies, I get frustrated as well, but it takes the amount of time and the variety of fires and different types of fires to have a reasonable study. And it was always intended to be five years of field data. So they are collecting that now into a report, and we will see a draft report in the coming months with the final report in 2019.

The CHAIRMAN. Final report—well, I understand what you are saying about how we want it to be comprehensive, but I think we also recognize that we, the Congress, have worked to provide you with some resources and some tools that you have been asking for, for a long time.

Ms. CHRISTIANSEN. Right.

The CHAIRMAN. But you acknowledge in your own statement that this is not a blank check to us.

Ms. CHRISTIANSEN. Right.

The CHAIRMAN. And so, making sure that we are doing right by these reforms, we are doing right by these additional dollars that are coming your way, these additional resources—we want to be guided by things that are going to make some sense.

One of the things I hear is that when it comes to aircraft to achieve certain suppression objectives that it is a somewhat random thing. It is like well, what do we have over here? You pull this in. That is not cost efficient. That is not using our money smartly. I would hope that you are trying to get this into alignment.

Ms. CHRISTIANSEN. Yes.

The CHAIRMAN. That we are not going to just blow through the resources that we have this year because we have it and next year we promise to do it smarter because we are going to have the results of the study. If you have information that can help point you in a better direction now, I would hope that you are setting yourself up to do just that.

Ms. CHRISTIANSEN. Yes, Senator, we are.

We actually implemented last year—the longer study is ongoing and we look forward to those results and getting preliminarily briefed here soon. But we also have the technology now with our scientists to, within a 12-hour turnaround, have real-time maps to our incident management teams where they can see the effectiveness of the prior burning, the window of response and was that effective, did we just burn through the retardant drops that we thought were going to be effective. So we're doing some real-time learning as well as the longer-term, a view study. With both of those we are making adjustments, and we will have more information and be glad to work with you on that.

The CHAIRMAN. Well, I would appreciate that. I think you heard similar concerns from both Senator Cantwell and Senator Wyden on this.

Ms. CHRISTIANSEN. Yes.

The CHAIRMAN. Again, we see that yes, these are extraordinarily important assets. We want you to have those aviation assets, but we also want to know that we are being smart with all of this. And thus, the request for the study back in 2012 and thus, the frustration. Actually, if my math is correct, if we really did put this in place in 2012, we are beyond our five years now.

So—

Ms. CHRISTIANSEN. Yeah, the first field season, I believe, was in 2013.

The CHAIRMAN. Okay, alright.

Ms. CHRISTIANSEN. Yeah.

The CHAIRMAN. Hurry it up.

[Laughter.]

Ms. CHRISTIANSEN. Okay, we will.

The CHAIRMAN. Alright.

I have no further questions at this point in time, but again, if colleagues have submissions you will see them.

I know it is not a policy but maybe we just pray for rain this summer and we also pray for the safety of the men and women who are out there on the front lines. I think we all know that this is very dangerous, and we have lost far too many as they have been out there on the front lines. Hopefully it will be a safe season.

With that, the Committee stands adjourned.

[Whereupon, at 11:36 a.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Questions from Senator Ron Wyden

Question 1: At the hearing, I asked what the Forest Service would do if it found itself in the position of not having enough air tankers for a given situation. You mentioned having additional “surge capacity” that the Forest Service could bring on. I would like to understand this better.

How are surge tankers deployed, how many surge capacity tankers are available, where would they come from, and how quickly could they be deployed to a wildland fire?

Answer: As we did last year, the USDA Forest Service currently has up to 25 Next Generation airtankers available for wildfire suppression nationwide (13 through Exclusive Use contracts, up to 11 through Call When Needed Basic Ordering Agreements, and one HC-130 aircraft on bail from the U.S. Coast Guard). When surge capacity is needed, the Forest Service will also have the capability to mobilize up to seven military HC-130s equipped with Modular Airborne Fire Fighting Systems, two Convair 580 airtankers through an agreement with the state of Alaska, and up to four additional Convair 580 airtankers from Canada. Also available for wildfire suppression, are four Call When Needed CL415 Water Scoopers, up to nine Water Scoopers available through an agreement with Canada, and one single engine airtanker through an Exclusive Use contract.

The National Interagency Coordination Center, in conjunction with Forest Service leadership and the National Multi-Agency Coordinating Group, determine when Call When Needed airtanker services are needed, as well as where to allocate these resources. This evaluation is done on a daily basis and the Forest Service uses predictive services and projected resource requirements to anticipate surge capacity needs well ahead of critical timelines.

When airtanker services are needed, the Federal government follows the Mission Ordering Procedures outlined in the Basic Ordering Agreements to determine best value for the order. Once issued, the order forms a contract with the airtanker vendor. Contractors are required to keep the aircraft desk at the National Interagency Coordination Center informed on the location and availability of their aircraft for assignments, and the process can be completed within a few hours.

Question 2: During the hearing you mentioned the work the agency is doing through its use of science in its Predictive Services. The Joint Fire Science Program is critical for understanding how wildfires act, and has a big impact in Oregon. Researchers have used the funding to look at the effectiveness of different kinds of prevention and suppression tactics. It also enabled local ranchers to share their know-how with federal officials, which improved the government’s response to wildfires. This program costs very little, but pays big dividends by helping the Forest Service make smarter decisions when it comes to wildfire. I am disappointed to see that President Trump proposed zeroing out this program again for FY19.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Does the Forest Service believe it can produce the same type of fire research without the Joint Fire Science Program, or this program on the chopping block again because funds are stretched thin?

Would any capabilities be affected if the Joint Fire Science Program is cut?

Answer: The Joint Fire Science Program has developed valuable projects that help land managers make critical decisions during the wildfire season. Our capability to conduct fire research will not be impacted as a result of the loss of funding for the Joint Fire Sciences Program, but the primary focus of this research will be on supporting implementation of the National Fire Plan.

Question 3: I want to know what the Forest Service is doing to better protect Americans from wildfires. Two weeks ago, the Oregon Department of Forestry released a new web tool called the Oregon Wildfire Risk Explorer. This tool lets you enter any location in the state, and it shows you the wildfire risk. I think this is a terrific new capability, and I'm glad to see the Forest Service partnered with folks in Oregon to make it happen. There's also a multi-agency program called Predictive Services that helps to anticipate major fires and determine the best allocation of resources

How will the Forest Service use these tools, and the larger suppression budget that came out of the FY18 Omnibus, to better plan for and manage wildfires?

Answer: The USDA Forest Service currently provides information similar to that found in the Oregon Wildfire Risk Explorer through applications like the Enterprise Geospatial Portal. This information, coupled with the predictive services information and products provided by the Wildland Fire Assessment System and InciWeb, provide data on both fire danger and fire location, and size information. There are several technology enhancements in development to provide more finite, near real-time fire, weather, fire danger, and fire behavior information. These efforts will also improve the wildland fire data and information exposure provided to interagency firefighters, the public, and interagency decision makers.

There are 11 predictive services units throughout the nation. Each unit contains personnel from both USDA Forest Service and the Department of the Interior. The units closely monitor conditions in their local area to provide better information about weather and fuel conditions that help predict the incidence of wildfires. The data produced by the predictive services units are shared via public websites from each Geographic Area Coordination Center.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Question 4: What is the Forest Service doing to get the new forest management authorities, like the 20-year stewardship contracts, up and running quickly?

Answer: The USDA Forest Service is undertaking a number of activities to implement the new authorities in the Consolidated Appropriations Act, 2018. The agency has developed templates that incorporate the Good Neighbor Authority road maintenance provisions. The Washington Office has provided guidance to the regions on the scope of the wildfire resilience categorical exclusion, and, in turn, the regions are developing plans outlining how they intend to use this new authority. We are also actively working with our partners to develop pilot projects utilizing the 20-year stewardship agreements and contracts authority. On May 31, 2018, the Forest Service and the National Forest Foundation hosted an online session with agency, industry, non-profit, community, and other stakeholders to solicit information that will help inform agency guidance for strategic use of this new authority and selection of forests to carry out the pilot projects

Questions from Senator Joe Manchin III

Question 1: I was glad we were able to get a much-needed fire-borrowing fix in the 2018 Omnibus in March, as well as providing \$1.37 billion to the Forest Service to go towards forest restoration and to improve forest health and reduce the risk of wildfire. A lot of restoration efforts are underway in the Monongahela, whether it be timber projects supporting the local communities and improving forest health and prescribed burns. In fact, the Forest Service planned and conducted prescribed fires on 5,000 acres and six different locations in the Monongahela from Mid-March through May.

Are similar efforts, such as what I just described, being replicated in other regions of the country?

Answer: Yes. The USDA Forest Service is expanding our forest management activities throughout the country, and we have several efforts underway to replicate the best practices that have been used on some of the highest performing units like the Monongahela National Forest. For example, we have increased targets for prescribed burns and timber harvest across the country. We began a national effort to increase the efficiency of our environmental analysis and decision making and forest products delivery systems, including a Business Operations Cadre focused on increasing use of the grants, agreements and innovative contracting mechanisms. Our regional staff are also developing strategies to implement the new forest management authorities in the Consolidated Appropriations Act, 2018, which will further advance our restoration efforts.

Question 2: Ms. Christiansen, as you mentioned in your opening statement, the 2017 fire season was one of the worst on record with millions of acres burned and thousands of homes and other structures destroyed. The final tally I saw for 2017 was 71,500 fires at a total cost of \$2.9 billion

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

dollars. I would like to hear your thoughts on education efforts being done by the Forest Service to inform the public on the dangers of wildfire and what the public can and should do to reduce fire danger. The Forest Service has at its disposal one of the most recognizable mascots for public education, Smokey Bear, to help drive the point home.

What sort of public awareness and education campaigns have you considered and are they effective?

Answer: The USDA Forest Service works in collaboration with many partners to promote wildfire prevention education awareness. Some of these efforts utilize Smokey Bear's name and image; others do not.

The National Wildfire Coordinating Group Communications, Education and Prevention Committee, with representation from all federal agencies and the National Association of State Foresters, develops training and maintains and promotes resources to ensure personnel are aware of wildfire prevention planning and education techniques. Fire Prevention Education Teams are utilized throughout the United States and have proven to successfully reduce the number of human-caused wildfires by increasing wildfire prevention education and awareness campaigns in high risk areas.

The Cooperative Forest Fire Prevention program is made of representatives from the Forest Service, the National Association of State Foresters, and the Ad Council. This group manages and leads the official, national Smokey Bear wildfire prevention campaign. In 2016, the program launched a redesigned Smokeybear.com website that is compatible for mobile devices and available in both English and Spanish. This year we are adding a feedback feature to learn more about the usefulness of the website. In 2016 and 2017, the program focused the Smokey Bear wildfire prevention campaign on causes of wildfire beyond those started by campfires. In 2019, we will celebrate 75 years of the Smokey Bear wildfire prevention campaign. Research indicates that for every dollar spent on wildfire prevention activities, 35 dollars is saved in wildfire suppression costs and losses. If more dollars are devoted to wildfire prevention, the agency strongly believes a reduction in human-caused wildfires will follow.

Questions from Senator Steve Daines

Question 1: Has the Forest Service and the Department of the Interior coordinated their internal environmental analysis review efforts to identify potential areas for improving one or both agencies' planning processes?

Answer: The USDA Forest Service participates in a quarterly federal planning/National Environmental Policy Act (NEPA) meeting with the Department of the Interior. To date, much of our discussion at these meetings has focused on information sharing and relationship-

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

building. For example, in October 2017, we coordinated the development of Federal planning presentations to the Association of Fish and Wildlife Agencies. We have also shared the results of internal surveys regarding implementation of the 2012 Planning Rule.

With respect to NEPA coordination, the Forest Service has attended monthly meetings with officials from the Department of the Interior, Bureau of Land Management and the Council of Environmental Quality to discuss opportunities for creating more efficient NEPA processes.

Question 2: On May 30th, the Forest Service announced plans to issue solicitations for Call When Needed Basic Ordering Agreements (BOA) and any resulting orders for Next Generation Large Airtankers (Sol. # 12-024B-18-R-9014) and Very Large Airtanker services (Sol. #12-024B-18-R-9015). Please provide an update regarding plans by the Forest Service to solicit and award contracts for Call When Needed and Next Generation 3.0 Exclusive Use contracts for Large Airtankers and Very Large Airtankers under the BOAs.

Answer: In May 2018, the USDA Forest Service began the acquisition process for additional large and very large airtanker services to meet the fiscal year 2018 Call When Needed requirements. The Request for Proposals for Call When Needed services was released on June 15, 2018, and the proposal due date will be extended to allow interested parties adequate time to review responses to submitted questions. The agency anticipates releasing the Next Generation 3.0 Exclusive Use Request for Proposal later this summer.

The agency also held a meeting with industry representatives on June 8, 2018, in Boise, Idaho to discuss the airtanker requirements and possible improvements to Federal contracting mechanisms. A follow-up meeting with vendors is scheduled for the fall of 2018.

Questions from Senator Mazie Hirono

Question 1: Funding from one of the Forest Service's Wildland Fire Programs, the State Fire Assistance Program, is very important to supporting pre-suppression, prevention, and training efforts in Hawaii. As you know, Hawaii does not have a National Forest so funding from programs such as this that assist state efforts is critical to helping our state and local communities prepare for and respond to wildfire.

The Administration's FY19 budget proposes to decrease funding to this program by nearly 20 percent, which I strongly oppose. How does the Forest Service plan to continue supporting states' pre-suppression, prevention, and training efforts amid these significant cuts?

Answer: State Fire Assistance funding is available for an array of activities that reduce risk and help communities become more fire adapted, and to build local capacity for effective response to wildfires. This funding is allocated using a methodology that incorporates the tenets of the

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Cohesive Wildland Fire Strategy, which promotes an “all hands, all lands” approach and encourages local collaboration and innovation to address wildland fire challenges. Each state, including Hawaii, is provided a base amount of funding, and states are granted flexibility in how they use State Fire Assistance funding to meet the highest priorities identified within each state. In addition, there are State Fire Assistance competitive grant funds available to address specific wildland fire requirements. Sixty percent of the funds allocated for these competitive grants are available to the states in the western United States, including Hawaii. In fiscal year 2017, Hawaii received \$500,000 of State Fire Assistance competitive grant funds to address priority needs; in fiscal year 2018, Hawaii will receive just over \$434,000 in funding for State Fire Assistance competitive grants. Both amounts are in addition to the base funds Hawaii received.

Question 2: As I’m sure you are aware, as it has gained international attention, communities along the Lower East Rift Zone of Kilauea on Hawaii Island are currently dealing with an active lava flow. While we understand the direct impact of lava burning and destroying whatever it comes into contact with, there are side effects associated with a volcanic eruption that include the impacts of air pollution known as vog and ashfall on vegetation in surrounding areas.

Does the Forest Service conduct research on how vog and ashfall could contribute to hazardous fuel loads and wildfire threats to communities near lava flows?

Answer: The USDA Forest Service is not directly researching the impacts of vog and ashfall on vegetation or its link to fire threats. However, anecdotal observations suggest that fuel loads would increase due to plant and tree mortality associated with vog. Moreover, the Forest Service is collaborating with Massachusetts Institute of Technology scientists, who have built a low cost vog monitor, on a citizen science program to install many of these devices around the island. Once in place, these monitors will provide a measure of vog by which the agency may examine its impacts on the environment.

Questions from Senator Catherine Cortez Masto

Question 1: Invasive species, climate change, and the effects of prolonged drought are creating conditions that are leading to larger, more frequent, and more intense fires in Nevada, and generally across the West. What have we learned over these past few years of rising wildfire frequency and intensity to anticipate and suppress wildfires, and what can we do to ameliorate their intensity?

Simply put, are we ready to combat another intense fire season?

Answer: Yes, we stand ready to deal with this year’s fires, managing for public and firefighter safety and protecting America’s resources to the best of our ability. At this time, the USDA

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Forest Service believes the number of firefighters, engines, aircraft, and other wildfire suppression assets are appropriate to meet its needs within available funding.

The Forest Service continues to make progress in reducing wildfire risk. Prioritizing hazardous fuels treatments to reduce wildfire risk can have an immediate impact to protecting communities and improving forest conditions. The passage of the Consolidated Appropriations Act, 2018 brought a suite of new authorities to accelerate the scope and scale of improving forest conditions and reducing wildfire risk. The Chief directed each region to develop an implementation strategy to make improvements to how we do business.

The agency works closely with our partners to ensure we are making risk informed decisions in preparing and responding to wildland fire using the best available science. The agency is rolling out an updated National Fire Danger Rating System to better gauge current and predicted fire danger levels and make informed, interagency decisions in responding to wildfire. The Forest Service is also utilizing Risk Management Assistance Teams to apply existing and emerging decision support tools to improve the effectiveness of the agency's fire management response.

Question 2: In 2017, 53 percent of fires in Nevada were caused by humans. What do individuals need to know to be more conscientious and more cautious in preventing wildfires?

Answer: The USDA Forest Service has a very active wildfire prevention program. It is estimated that 80 to 90 percent of all wildfires are human-caused and, therefore, potentially preventable. The agency prevention program uses a number of techniques to reduce human-caused wildfires. They include providing environmental education; actively patrolling high risk areas and making public contact; working with industry to engineer better outdoor equipment; and raising public awareness through signage and enforcement of fire use and safety regulations.

Individuals need to be conscientious any time they are in burnable areas. They can ensure this by making sure chains or other metallic objects do not drag on paved roadways when driving; assuring equipment is outfitted properly with spark arrestors; being aware of the conditions around them; and paying attention to no burn days, as well as weather forecasts that warn of high fire danger.

Question 3: We have now entered an era where we do not refer to wildfire season as "fire seasons" anymore – we live in a time when wildfire is now "year-round." The National Significant Wildland Fire Potential Outlook issued by the National Interagency Fire Center on June 1, estimates that above normal significant wildland fire potential is possible over parts of western/northwestern Nevada. As wildfires become more constant and the threat of potential wildfire increases, are there concerns about resources and staffing?

- If so, why decrease the number of full-time employees by six percent?

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Answer: In fiscal year 2019 the USDA Forest Service plans on staffing the same number of firefighters, 10,000, as it has in previous years. Maintaining core firefighting capacity is a primary objective of the agency, and significant effort is placed on ensuring that both permanent, seasonal and contracted firefighting assets are available throughout the fire year to support operations. The agency continues to look to increase programmatic efficiencies, including decreasing overhead, to maximize our ability to deliver firefighting capability.

Question 4: Under President Trump's budget, cuts to the Forest Service would impact state and private forestry budgets. In fact, the Nevada Division of Forestry (NDF) could experience a substantial funding loss, which would have a huge impact on wildland fire suppression and fire prevention. Can you elaborate on those potential impacts and concerns?

Answer: Decreased funding to State and Private Forestry programs does not diminish our commitment to longstanding partnerships with federal, state, Tribal, local, and non-profit groups to sustain the health, diversity, and productivity of the Nation's forests. The fiscal year 2019 Budget requires greater emphasis on shared stewardship with states, communities, and private landowners to accomplish forest management goals and prioritize hazardous fuels treatments to reduce wildfire risk.

Question 5: Over 74 percent of the area around Tahoe Lake is public land managed by the Forest Service. After decades of fire suppression, the Tahoe Basin's overstocked forests are highly vulnerable to insect, disease and catastrophic wildfire. They lack the diversity in age-structure and species distribution to support a healthy forest ecosystem. Forest management projects are essential to the safety of Tahoe's communities and the health of its forests. The threat of a catastrophic wildfire at Lake Tahoe is a top concern for the entire community. With the increasing outlook for an above normal significant wildland fire potential in northwestern Nevada, what precautions is USFS undertaking to safeguard this area, in particular?

Answer: The agency is utilizing all available tools to reduce the threat of catastrophic wildfire caused in part by the unprecedented mortality occurring in California's National Forests. From a forest management perspective, we are utilizing the categorical exclusion from NEPA for insect and disease projects authorized in the Agricultural Act of 2014 and the categorical exclusion for wildfire resilience projects in the Consolidated Appropriations Act, 2018 (the Omnibus bill). These categorical exclusions will allow us to implement treatments in areas on a quicker basis to reduce the hazardous conditions that have been created. We are also looking to expand the use of the Good Neighbor Authority program to partner with the state to implement restoration treatments.

We have engaged in normal preseason preparedness meetings with partners and cooperators to ensure the highest level of readiness for operational firefighting resources. In addition, the Pacific Southwest Region of the Forest Service received the highest percentage of funding for hazardous fuels treatments of any region in the agency. This funding will be directed to the highest priority areas. Also, \$2.5 million is dedicated to Lake Tahoe Restoration Act Forest

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Health and Fire Protection projects in the Lake Tahoe Management Unit. The agency intends to take full advantage of the new authorities passed in the Omnibus bill to accelerate the improvement of forest conditions and reducing fire risk. This will have a significant impact this fire season and in years to come.

Question 6: Nevada is a naturally fire prone state which last year burned 1.2 million acres and has approximately \$10 billion in moderate to very high risk of potential community exposure to wildfire damage. Nevada has invested in research activities to better predict the risk of wildfire, address those risks with prevention strategies, use technology to fight fires, and analyze the threat to communities post-fire. Yet the President's budget continues to cut wildfire research programs through the U.S. Forest Service R&D accounts and the Joint Fire Science Program, an innovative program specifically designed to perform and deliver research and recommendations at the land managers' request to help them combat wildfire conditions and effects. This program is directly responsive to their needs. How does this Administration plan to support research funding to provide decision-support for planning and operations in what is expected to be a significant wildfire year as well as in future years?

Answer: USDA Forest Service Research and Development is the nation's leader in the development and implementation of tools and systems to support planning, decision-making, and operational support for wildland fire. The reduction or elimination of funding for fire research programs within the Research and Development appropriation, including the National Fire Plan and Joint Fire Sciences Programs will result in more focused leveraging of funds with other Forest Service deputy areas and also with our partners in the fire community. For example, Forest Service Research and Development is funded by the State and Private Forestry Fire and Aviation Management program to maintain the National Fire Decision Support Center for developing, training, and implementing fire decision support for Nevada and the entire country. Forest Service Research and Development is also actively engaged with multiple western communities in their development of Community Wildfire Protection Plans.

- How are you coordinating these research activities between federal agencies and with academic partners, especially those in our Western States which have firsthand knowledge of wildfire?

Answer: USDA Forest Service Research and Development is a full partner with all signatories of the National Cohesive Wildland Fire Management Strategy. Forest Service Research and Development also collaborates with scientists from the U.S. Geological Survey, the Department of Defense's Environmental Security Technology Certification Program, and the national, collaborative network of 15 regional fire science exchanges (or Fire Science Exchange Network) to deliver science and tools to a variety of end users for practical applications. In addition to our federal partners, universities are critical partners, particularly regarding western wildland fire. From 2013 through 2017, Forest Service Research and Development has administered nearly 100 agreements with units comprising the Nevada System of Higher Education, totaling over \$22 million.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

Question 7: How are you making use of other federal programs such as NOAA's Regional Climate Centers and inter-agency drought monitoring programs to help federal, state and local agencies and emergency planners better predict the incidence of wildfires?

Answer: The USDA Forest Service has a long-standing relationship with regional climate centers such as the Desert Research Institute at the University of Nevada, Reno, a partnership that has been in existence for more than 30 years. We work closely with the Desert Research Institute to develop better forecasting models for both fire weather and smoke dispersion, such as the California and Nevada Smoke and Air Consortium model known as CANSAC.

There are 11 predictive services units throughout the nation. Each is interagency in nature, with personnel from both USDA Forest Service and Department of the Interior. The units closely monitor conditions in their local area to provide better information about weather and fuel conditions that help predict the incidence of wildfires. The Forest Service has several agreements in place with National Oceanic and Atmospheric Administration (NOAA) agencies, including the National Weather Service to provide better forecasting tools. USDA partners with NOAA and others to produce the United States Drought Monitor, a tool fire behavior specialists utilize frequently. The data produced by the Predictive Services units is shared via public facing websites from each Geographic Area Coordination Center.

Question 8: How are you supporting research to help communities that fall victim to wildfire better assess the potential risk of post fire emergency situations, such as flash floods and mudslides?

Answer: USDA Forest Service Research and Development works with Forest Service National Forest System and key partners such as Tribes, the Environmental Protection Agency, the National Aeronautics and Space Administration, the Bureau of Land Management, the National Forest Foundation, and the UK Natural Environmental Research Council to advance this research. We have developed tools that support post fire erosion and flood predictions in all of the western states, including Nevada. We have also developed online tools to allow federal, state or local agencies to make such predictions without our direct assistance. Forest Service Research and Development continues to provide decision support tools and information for post-wildfire management efforts to Burned Area Emergency Response teams and to enhance forest land management. These tools are widely used by the Forest Service and other federal, state and Tribal agencies to identify areas most vulnerable to post-fire erosion and flood prediction.

Question 9: How can we make better use of Unmanned Aircraft Systems and other technologies to help predict and prevent fires and fight those fires when they occur? Where are monitoring and response operations lacking in utilizing the full extent of our technological and data sharing capabilities?

Answer: The USDA Forest Service has been working closely with the Department of the Interior's Unmanned Aircraft Systems (UAS) offices and personnel for years. The Forest Service

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

is currently negotiating an agreement to expand the scope and simplify the process of accessing this support.

The National Wildfire Coordinating Group, an interagency body representing Department of the Interior Bureaus with wildland fire responsibility, the Forest Service, and states, published the Interagency Fire UAS Operations Guide, which was developed by the National Interagency Aviation Committee's Interagency Fire UAS Subcommittee. Department of the Interior, Forest Service and State Subcommittee members all contributed to the Guide. Service First agreements and the interagency Resource Ordering and Status System facilitate immediate UAS support for wildland fire management. UAS fire management missions include tactical reconnaissance, situational awareness, mapping, infrared detection and fire crew operational support.

Question 10: The Forest Service is projecting a very strong probability for Northern Nevada to see wildfires early this summer. In what ways is the Forest Service coordinating with state firefighters?

- What are ways in which the Forest Service can improve coordination between other agencies and state partners?

Answer: Through the State Fire Assistance and Volunteer Fire Assistance programs, the USDA Forest Service provides financial assistance to state and local response agencies for the prevention, mitigation, control, and suppression of wildfires on non-Federal lands. The programs emphasize pre-fire planning and hazardous fuels mitigation near communities at risk. In addition, training funded by these programs provides more effective and safer initial response to wildfire.

The National Wildland Fire Cohesive Management Strategy emphasizes collaboration and coordination across jurisdictional boundaries. There are dozens of examples around the country where the Forest Service is working closely with our state and local partners to reduce wildfire risk. These include the Blue Mountains in Oregon, the Greater Okefenokee area in Georgia and Florida, the Flagstaff Watershed Protection Project in Arizona and the Mashpee Collaborative in Massachusetts, to name a few.

In Nevada, Northeast Nevada Interagency Fire Management is an early Cohesive Strategy Success Story. The Humboldt-Toiyabe National Forest partners with the Bureau of Land Management under a Service First Agreement to provide dispatching, fire preparedness, and fire suppression support in the state. The Service First interagency partners, the Nevada Division of Forestry, the U.S. Fish and Wildlife Service, and the Duck Valley Tribe constitute the Northeast Nevada cooperators. Other agreements are in place to share resources with the Nevada Division of Forestry and other local entities throughout the state.

The Great Basin Coordination Center as well as the National Interagency Coordination Center work to assure there are appropriate resources available to meet the anticipated needs for

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Chief Vicki Christiansen

wildland fire management. We also use the provisions in the Good Neighbor Authority on a regular basis to work with state partners.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Mr. Jeff Rupert

Questions from Senator Mazie Hirono

Question 1: As I'm sure you are aware, as it has gained international attention, communities along the Lower East Rift Zone of Kilauea on Hawaii Island are currently dealing with an active lava flow. While we understand the direct impact of lava burning and destroying whatever it comes into contact with, there are side effects associated with a volcanic eruption that include the impacts of air pollution known as vog and ashfall on vegetation in surrounding areas. Does the Department of the Interior conduct research on how vog and ashfall could contribute to hazardous fuel loads and wildfire threats to communities near lava flows?

Answer: While the United States Geological Survey (USGS) and the National Park Service (NPS) have not yet conducted vog and ashfall research related to wildfire risks, they are monitoring and documenting the current sequence of events at Kilauea in coordination with the State of Hawaii. The eruption is very complex and dynamic and, in general, scientific resources are more engaged with aspects of the eruption that pose more immediate threats to life and property. With the eruptions at Kilauea scientists recognize the unique opportunity to address the question of the interaction of vog, laze and ashfall with wildfire. Currently, we're considering opportunities to work with our partners to capture data and information that will help us address this question.

Question 2: Last month the Department of the Interior announced that it awarded a Call When Needed contract to four companies that allows the Department to obtain contractor-operated and maintained drones to support wildfire management activities. However, the contract only covers the Contiguous 48 states and Alaska.

Given the challenging terrain throughout our islands, it seems that the option for additional drones would be very helpful to wildfire management activities. What led to this service not being available in the state of Hawaii? Are there challenges unique to Hawaii that prevented our inclusion in the contract and does the Department have future plans to expand the contract to cover all 50 states?

Answer: In FY 2017, there were no Department of the Interior (DOI) drone, or unmanned aircraft system (UAS), flights in Hawaii. In FY 2018, so far there have been more than 221 flights. The DOI UAS fleet in Hawaii has expanded to 14 aircraft on Hawaii, Maui, Oahu, and Molokai. The DOI drone program continues to support resource monitoring and emergency services at Kilauea with 12 aircraft from the fleet stationed on Hawaii. As you are aware, a DOI drone recently assisted with a search and rescue operation in an area adjacent to the eruption. This quick adaptation to both emergency and traditional resource monitoring needs is the hallmark of the DOI's growing UAS program.

The contract for the call when needed services is currently under modification to allow the vendors to deploy aircraft to Hawaii. This development will provide call when needed UAS support in all 50 states.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Mr. Jeff Rupert

Questions from Senator Catherine Cortez Masto

Question 1: As you know, cheatgrass is an invasive, fire-prone plant that has a tendency to spread even more rapidly after a wildfire, displacing sagebrush, which is crucial habitat for sage grouse, and is important for ranching as well. Interior's "Sagebrush in Prisons" program, in which prison inmates cultivate sagebrush seedlings to be provided to public land management agencies to restore sage grouse habitat destroyed by wildfire and invasive cheatgrass, has had positive outcomes and has been met with positive feedback. In 2017, Nevada inmates cultivated 210,000 plants. However, the Administration seems to have suspended this program. What is the status of this program?

Answer: In FY18, the BLM expended \$330,000 of FY17 funds to support the Institute for Applied Ecology to run the Sagebrush in Prisons Program in 5 prisons in 3 states (NV, ID, OR). This is reduced from previous years which funded 11 prisons in 6 western states.

The BLM is working in a partnership with the Institute of Applied Ecology in support of the Sagebrush in Prisons Program. Currently, all agreements are being reviewed to ensure that they are an efficient tool for management of the public lands and that they properly follow the federal procurement process. This review is being conducted in coordination with each of our state offices. The Sagebrush in Prisons program is included in this review because it has been funded through agreements in the past.

A. Would it not be more expensive to cultivate sagebrush seedlings through other means?

Answer: Different sagebrush species grow in different environments, thus BLM provides locally adapted sagebrush seed for inmates to grow into seedlings. The other sources of sagebrush seedlings are state and federal nurseries in Idaho, Oregon, and Nevada.

B. What other measures are being undertaken to cut down on post-fire invasive species?

Answer: The BLM takes seriously the threat of invasive species following wildland fire. The following are some of the measures BLM is taking to limit the spread of invasive species:

- The BLM Plant Conservation & Restoration Program has established an ecoregional program for the Great Basin that is working to increase availability of native seed for restoration and rehabilitation (CA, ID, NV, OR, UT).
- BLM is working with Dr. Beth Leger (UNR) to investigate native forbs that can compete with cheatgrass. Preliminary results indicate that native plant populations are adapting to cheatgrass and these can be selected for commercial production.
- The BLM's weed and invasive species management program utilizes weed prevention, early detection and rapid response to reduce post-fire return in combination with invasive species inventory, treatments, restoration, and monitoring that includes fuels reductions, emergency fire stabilization, and coordinates weed treatments with private, state and

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Mr. Jeff Rupert

county cooperators. The BLM uses an integrated pest management approach (IPM) using a combination of chemical, biological, mechanical and prescribed fire treatments.

Question 2: Nevada is a naturally fire-prone state which last year burned 1.2 million acres and has approximately \$10 billion in moderate to very high risk of potential community exposure to wildfire damage. Nevada has invested in research activities to better predict the risk of wildfire, address those risks with prevention strategies, use technology to fight fires, and analyze the threat to communities post-fire. Yet the President's budget continues to cut wildfire research programs through the U.S. Forest Service R&D accounts and the Joint Fire Science Program (JFSP), an innovative program specifically designed to perform and deliver research and recommendations at the land managers' request to help them combat wildfire conditions and effects. This program is directly responsive to their needs. How does this Administration plan to support research funding to provide decision-support for planning and operations in what is expected to be a significant wildfire year as well as in future years?

Answer: Working within budget parameters that are in-line with the President's priorities to reduce spending while increasing efficiency, the USGS and the Bureau of Land Management (BLM) continue to research fire risk in Nevada. In partnership, they are exploring the interrelationship of wildland fire risk, cheatgrass, and the sagebrush ecosystem. More broadly, wildland fire science partners, including the DOI, U.S. Forest Service, Department of Defense (DOD), NASA, Tribes, states, universities and non-government organizations, extensively collaborate to provide wildland fire science support for planning and operational decision-making.

- A. How are you coordinating these research activities between federal agencies and with academic partners, especially those in our Western States which have firsthand knowledge of wildfire?

Answer: National level coordination continues through the Wildland Fire Leadership Council, which includes fire management agencies in DOI and the Department of Agriculture, partners in the Department of Homeland Security, DOD and USGS, as well as representatives of state foresters, governors, local government and Tribes. At regional and local levels, the DOI's bureaus continue to coordinate closely with state and local governments, community groups and other stakeholders on mutual concerns or shared issues, often through the regional Fire Science Exchanges. Regarding Nevada, the "Integrated Rangeland Fire Management Strategy Actionable Science Plan" provides a common resource for federal, state and local governments, non-governmental organizations, and communities interested in addressing priority research needs. Within DOI, the USGS and BLM coordinate through regular communications at the staff level and through venues convened by regional organizations such as the Great Basin Consortium.

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Mr. Jeff Rupert

In addition, Federal scientists regularly collaborate on research projects with academic partners. The SageSTEP research program, initially established through JFSP funding, is an example of scientists from different federal agencies and universities studying the management of wildland fire, cheatgrass and sagebrush. They regularly meet at field and national levels with fire and land management programs to share research results on challenges of the sagebrush steppe and gain feedback from managers.

Question 3: How are you making use of other federal programs such as NOAA's Regional Climate Centers and inter-agency drought monitoring programs to help federal, state and local agencies and emergency planners better predict the incidence of wildfires?

Answer: The Predictive Services Unit of the National Interagency Fire Center relies extensively on NOAA and interagency drought monitoring efforts. During fire season, the Predictive Services Unit uses NOAA data to produce a monthly National Significant Wildland Fire Potential Outlook that is used by wildland fire managers to inform wildland fire management decisions and proactive strategies. Regional Predictive Services staffs within the Geographic Area Coordination Centers also coordinate with and rely on state and regional climate and drought monitoring centers.

Question 4: How are you supporting research to help communities that fall victim to wildfire better assess the potential risk of post fire emergency situations, such as flash floods and mudslides?

Answer: The DOI supports post fire risk research through a number of avenues. Monitoring and emergency stabilization efforts are initiated for large wildfires even while Incident Management Teams are actively managing an incident. Local and regional line managers decide if Burned Area Rehabilitation Teams should be deployed to conduct wildfire severity and post-fire risk assessments. USGS programs provide support to teams and communities that are addressing post-fire risks with information on burn severity, debris-flow risk assessments and monitoring, satellite imagery, flood potential assessments and stream flow (with existing stream gauge network, or add additional temporary gauges). Specialists use these tools in concert with NOAA weather information and warning systems, and hydrologic monitoring. USGS also leads extensive hydrologic, debris flow, and vegetation recovery research across Federal and State agencies. For example, researchers with Northwest Climate Science Center modeled future wildfire activity through 2050 and used these projections to produce an assessment of fire-induced soil erosion for the West.

Question 5: How can we make better use of Unmanned Aircraft Systems and other technologies to help predict and prevent fires and fight those fires when they occur? Where are monitoring and response operations lacking in utilizing the full extent of our technological and data sharing capabilities?

U.S. Senate Committee on Energy and Natural Resources
June 5, 2018 Hearing: *The 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and U.S. Forest Service*
Questions for the Record Submitted to Mr. Jeff Rupert

Answer: The DOI's use of UASs to gather data for fire prediction models, weather forecasts, and real-time fire behavior during active fire suppression is a technological leap forward in using aircraft to support wildland fire management. The DOI's UAS program continues to explore the potential for quickly integrating new sensor technology to improve operational capabilities of UASs. The most recent example of this integration comes from emergency support for the Kilauea eruption where drones monitored the concentration of toxic gases with air sensors.

While the current drone program has grown to one of the largest, most diverse, and most successful domestic programs in the United States, it is still expanding. The DOI is preparing for field tests of UASs designed for use as an aerial ignition device for prescribed fire. This approach has the potential to increase effectiveness of fire management while reducing risks for fire managers on the ground. The DOI is also testing the feasibility of adding optionally piloted helicopters to its aerial support fleet. The same helicopters we already use for wildfire support would return to the helibase at the end of the day, get quickly reconfigured for remote flying, and then serve night operations while pilots rest. This means tripling the support these aircraft provide.

Question 6: The Department of the Interior is projecting a very strong probability for Northern Nevada to see wildfires early this summer. In what ways is the Interior coordinating with state firefighters?

- A. What are ways in which the Interior can improve coordination between other agencies and state partners?

Answer: The DOI improves coordination between wildland fire protection agencies as an ongoing process in the Great Basin. The fire program managers of the various state and federal agencies involved in wildland fire protection meet regularly as the Great Basin Coordinating Group. This group focuses on developing plans that ensure a coordinated approach for wildland fire protection within the Great Basin Geographic Area.

Annual operations procedures and plans guide Great Basin Multi-Agency Coordinating Group activities when unusual or critical fire activity and resource mobilization requires continuous, daily interaction between agencies. This ensures that decisions not covered in existing plans and guides are responsive to the priority interests of the geographic area as a whole.

**Center for Biological Diversity * Conservation Northwest
Defenders of Wildlife * Earth Justice * KS Wild
National Parks Conservation Association * Sierra Club
The Wilderness Society * Western Environmental Law Center**

June 18, 2018

The Honorable Lisa Murkowski
Chairman
U.S. Senate
Energy and Natural Resources Committee
304 Dirksen Senate Office Building
Washington, D.C. 20510

The Honorable Maria Cantwell
Ranking Member
U.S. Senate
Energy and Natural Resources Committee
304 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Chairman Murkowski and Ranking Member Cantwell,

We write to provide our views on the full committee hearing to examine the 2018 Wildland Fire Outlook and the Wildland Fire Management Programs at the Department of the Interior and the U.S. Forest Service. We respectfully request that you include this letter in the hearing record.

We appreciate you taking the time to examine these important issues. Wildland fires play an important role in regulating ecosystems, but climate change, decades of fire suppression, unsustainable logging, and other activities have altered natural processes on our national forests and interconnected public lands. Meanwhile, more residential development near wildlands has increased the likelihood that fire will impact people and property, often with devastating consequences.

Last year's record setting fire season contributed to a tragic loss of life and property that drained federal, state, and local resources. The stories and images of wildland fire engulfing homes and communities are heart wrenching, and those impacted often look to lawmakers and land management agencies wanting to know what, if anything, could have been done to prevent these losses.

Fortunately, Congress recently took meaningful action by including a bipartisan fire funding agreement in the FY18 Omnibus. For years prior, the rising cost of wildland fires had forced the Forest Service and other land management agencies to borrow funds from other programs, including those intended to reduce fire risk near communities. By finally fixing how the federal government plans for and funds wildfires, Congress has provided the Forest Service with a unique opportunity to use their existing management tools and work with the public, states, and communities to address the needs of our national forests.

Despite the wildfire funding fix having strong bipartisan support in both the House and Senate, this commonsense policy solution lingered for years, hamstrung by the demand to pair the budget fix with controversial forest management policies. When properly applied, science-based forest management tools can help restore national forests and other lands

where needed and when paired with initiatives to create defensible space and community readiness, protect against the loss of life and property from wildland fire.

However, proposals to undermine bedrock environmental laws and recklessly promote logging over clean water, recreation, and wildlife do nothing to improve the health of our national forests, while creating public controversy and opposition.

Congress should resist legislating unsound logging projects and practices and allow the Forest Service to use the many existing tools it has at its disposal to help keep our communities safe from wildfire and preserve the priceless values that our national forests provide. The future of our national forests and public lands and the health and safety of our communities depend on the availability of adequate resources, science-based forest restoration, efforts to improve community readiness, and an understanding of the risks inherent to more development in fire prone areas. Reckless rollbacks of bedrock environmental laws like the National Environmental Policy Act, Roadless Rule, and Endangered Species Act are simply the wrong approach.

We encourage Congress to continue the important oversight needed to ensure that our land management agencies are properly funded, equipped to respond to wildland fire, appropriately applying forest management tools, and protect the clean water, wildlife, and recreational values of our public lands.

Thank you for considering our views.

Sincerely,

Center for Biological Diversity
Conservation Northwest
Defenders of Wildlife
Earth Justice
KS Wild
National Parks Conservation Association
Sierra Club
The Wilderness Society
Western Environmental Law Center



Corporate Office
40 Pacifica
Irvine, CA 92618
Phone: 949-214-3000
Fax: 949-214-3030
CoreLogic.com

June 5, 2018

U.S. Senator Lisa Murkowski
Chair, Senate Committee on Energy and Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

U.S. Senator Maria Cantwell
Ranking Member, U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

RE: Examining the 2018 Wildland Fire Outlook and Wildland Fire Management Programs

Dear Chair Murkowski and Ranking Member Cantwell:

On behalf of CoreLogic (NYSE: CLGX) please accept the following statement and attached materials for the record regarding the Committee's recent hearing on wildland fire management programs.

CoreLogic is a leading global property information, analytics and data-enabled solutions provider headquartered in Irvine, California. Our combined data from public, contributory and proprietary sources includes over 4.5 billion records spanning more than 50 years, providing detailed coverage of property, mortgages, hazard risk, consumer credit, tenancy, location, and related performance information. We serve diverse markets including real estate and mortgage finance, insurance, capital markets, and the public sector. Our vast data, powerful analytics, cutting-edge workflow technology, advisory and managed services help identify and manage growth opportunities, improve performance and manage risk.

CoreLogic's natural hazard and catastrophe solutions allow for insurers and enterprise risk managers to know property-level hazard risk across their portfolios. As the Committee recognizes, natural hazards including, but not limited to wildfires, floods, earthquakes, hurricane winds, and tornadoes present threats to Americans and the economy every year. We believe that having access to the latest technology and most accurate hazard risk insights can help improve how communities prepare for and respond to these types of natural hazards. Using proprietary science, our predictive modelling has helped risk managers answer three critical questions: What could happen? What if it happened? And, what did happen? After the record-breaking catastrophes across the United States in 2017, CoreLogic spent time reflecting, analyzing and evaluating the severity of natural hazard events in an effort to inform and protect homeowners and businesses alike.

Attached are two reports: the *2016 CoreLogic Wildfire Hazard Risk Report*, our latest insight and analysis of wildfire risk and associated reconstruction cost value for homes in thirteen western states; as well as our *Fire Protection Class* datasheet, highlighting fire risk evaluation capabilities for residential, commercial, and public properties. We hope these reports can serve as a resource to the Committee as it works with federal agencies, state governments, local communities, and private sector businesses to evaluate options and tools available to strengthen preparedness, response, and post-loss assessment capabilities across the United States.

Sincerely,

Stuart Pratt
Global Head, Public Policy and Industry Relations
CoreLogic



June 5, 2018

The Honorable Lisa Murkowski
 Chairman
 Senate Energy and Natural Resources Committee
 US Senate
 Washington, DC 20510

The Honorable Maria Cantwell
 Ranking Member
 Senate Energy and Natural Resources Committee
 US Senate
 Washington, DC 20510

Dear Chairman Murkowski and Ranking Member Cantwell:

The heads of state forestry agencies around the country have been key partners with the Agriculture Department's Forest Service and the Interior Department's Bureau of Land Management for many years. Collectively, we are represented by the National Association of State Foresters (NASF) and share with our federal partners the common goal of promoting the health and well-being of all of the nation's forest resources. This letter is to express our gratitude for the work of your committee in support of increasing active forest management on federal lands and our appreciation of the steps the Forest Service and Interior Department are taking to begin implementing newly enacted authorities.

Notably, recent improvements to the Good Neighbor Authority (GNA) have strengthened the ability of State Foresters to work with federal land managers to achieve even more results on the ground. We fully embrace this role and see it continuing to grow. Attached is a report we completed that assessed current and future work by state foresters under GNA. As noted in the report, 28 states have entered into GNA agreements and six more intend to do so. It is likely the remaining states do not have significant portions of federal land. Since the report and passage of the legislation, the agencies have provided additional training and the number of GNA projects continue to increase.

At the time we collected the information, 133 GNA agreements had been executed. These agreements led to a number of important projects that reduced fire risk, restored forests, curtailed invasive species/insect/disease, and allowed for important trail work, commercial timber sales, and fire salvage operations to occur. The Forest Service utilized categorical exclusions on many of these projects. On average, over 400 acres per vegetation management project were treated. We would expect this average to increase with the new authorities recently provided. It's also important to note that states invested some thirty percent of the project costs as many of these were cross boundary projects.

NASF believes significant improvements have been made through recent legislation and will continue to be made with the commitment from the Forest Service and Bureau of Land Management to work with the nation's State Foresters to more fully utilize this authority. These improvements will have lasting positive implications for America's forests. We expect to resurvey our Members within the next two years and find a significantly increased level of GNA participation and accomplishment. State Foresters

do, however, believe GNA could be utilized to even greater effect if all Interior Department agencies were allowed to participate in GNA projects and if State Foresters were able to partner with the Forest Service on forest inventory work on federal lands.

Again, thank you for your efforts in providing expanded authorities to improve all of our nation's forests. We are encouraged by the results of GNA efforts to date and look forward to an even stronger partnership with the Forest Service and the Department of Interior as we move forward.

A handwritten signature in black ink, appearing to read "George Geissler". The signature is fluid and cursive, with a long horizontal stroke at the end.

George Geissler
Washington State Forester
President, National Association of State Foresters

**NASF Forest Resource Management Committee
Survey of Good Neighbor Authority Implementation
January 24, 2018**

Background

The Good Neighbor Authority was made permanent under the 2014 Farm Bill and allows the Forest Service to enter into contracts and agreements with states to perform work on federal lands. As everyone searches for ways to increase the scope and scale of needed vegetative management on federal lands this authority has become an increasingly prominent tool.

To get a comprehensive view of the extent of use, and to collect suggestions on how it may be improved for even greater use, the Forest Resource Management Committee developed a questionnaire which was distributed to all NASF members in the fall of 2017.

Results

The following 38 states provided responses.

<u>West</u>	<u>Northeast</u>	<u>South</u>
Montana(Y)	Ohio(Y)	Virginia(Y)
Colorado(Y)	New Hampshire(N)	Alabama(Y)
Wyoming(Y)	Wisconsin(Y)	North Carolina(Y)
Nebraska(N)	Illinois(N)	South Carolina(N)
Alaska(Y)	Minnesota(Y)	Mississippi(Y)
Hawaii(N)	Delaware(N)	Arkansas(N)
Idaho(Y)	Pennsylvania(Y)	Kentucky(Y)
Kansas(N)	Michigan(Y)	Texas(Y)
Washington(Y)	West Virginia(N)	Florida(Y)
South Dakota(Y)	Connecticut(N)	Georgia(Y)
Nevada(Y)	Vermont(Y)	Tennessee(N)
New Mexico(Y)	Missouri(N)	
North Dakota(Y)		
California(Y)		
Utah(Y)		

1. Has your state entered into a Good Neighbor Authority Agreement

YES – 27

NO – 11 Specific states are indicated by (Y) or (N) above.

It's likely that a few non-responding states have, in fact, participated in GNA and it would be helpful to hear from them yet. Most of the 12 that have not responded, probably have not participated, but it would also be good to have that verification.

2. Do you foresee using GNA anytime in the future?

Of those 11 states who have not used GNA yet, 6 said yes, they thought they would.

3. Do you feel you have an adequate understanding of GNA, what the authority allows and how to go about initiating a project?

Of those who had not used GNA to date, 7 said they did not feel they had an adequate understanding of the tool. 4 of those 7 were ones who thought they might use it in the future: NE, MO, AR & WV

4. With which agency have you worked under a GNA Agreement?

21 states had worked solely with the USFS, while 6 had worked with both USFS and BLM.

5. How many agreements have you participated in?

In total GNA participants had entered into 129 agreements with the USFS and 4 with BLM, for an average of roughly 4 per participant. The highest number reported were:

- WI – 40
- MI – 31
- CO – 10
- ID – 10
- UT – 9

Everyone else actually had just used 1 or 2 agreements.

6. What were the primary vegetative management objectives?

We are currently underway in developing two SPAs to conduct vegetative management for salvage, insect and disease, and fuels reduction. We have, to date, no signed SPAs.

forest health, fuels reduction, forest restoration, invasive species control with the projects we are considering

Fuels Reduction, Landscape Resilience, & Pine Beetle Salvage/Sanitation

- Timber Stand Improvement - Fuels Mitigation - Timber Sale - Trail work
Watershed forest management and management of invasive plants

Southern pine beetle control and invasive species control

Timber sale for young growth timber on the Tongass National Forest. The project sold 28 MMBF of timber for \$2.8 million. Purchaser layout of about 2/3 of the sale is a unique feature of the project and an additional cost savings for us, thus the value of the sale exceeds the amount listed.

All of the >40 projects have been timber sales on multiple timber types (e.g., northern hardwood, red pine, aspen) with a variety of treatments as described in the national forest's plan (e.g., selection, thinning, clearcuts)

* Fire Salvage * Forest thinning for forest health (commercial thin) * Data collection for NEPA analysis on designated projects

We are engaging slowly and have begun a 800 plot inventory for data purposes so that other forest management objectives can begin.

Not applicable

Our GNA agreement was recently signed, August 2017. We have been awarded one project with the BLM in the Southern Nevada District Office. The management objectives are to improve forest and rangeland health and reduce hazardous fuels adjacent to the Wildland Urban Interface in southern Nye County and Clark County.

Timber harvest and regeneration of overage Aspen stands and some first and second thinning of Red Pine stands.

Southern pine Beetle spot ID and mapping.

1. Activities on and off NFS land to treat insect and disease infected trees; 2. Activities to reduce hazardous fuels; and 3. Other activities to restore or improve forest, rangeland and watershed health.

Both GNA supplemental project agreements contain vegetation management objectives developed to protect the many values at risk threatened by complex fire issues associated with drought, climate change, fuel loading, insects and disease. Protected values include communities, infrastructure, private timber, water, power, recreation, protected species, and improved fire frequency. The values and co-benefits to be protected in these watersheds are critical to the local and regional economies and to ecosystem health. Emphasis was placed on connecting treatments across all lands designed to defend hardened infrastructure points, high value investments and critical habitats. The focus areas are largely at the Wildland Urban Interface/Intermix (WUI) zone. The overarching objectives are to implement landscape-level projects that will demonstrate cross jurisdictional cooperation for fuel modification in high fire hazard areas of the State within existing statutory and regulatory frameworks ultimately leading to 1) resilient landscapes, 2) fire adapted communities and 3) safe and effective wildfire response.

fuels treatments

Forest health

Timber management: red pine thinning and early successional habitat (Aspen)

Thinning of overstocked stands of pine for forest health and fuels reduction.

Shared resources on both state land and the GMNF related in timber inventory and marking
fuel reduction forest health with thinning's wildlife improvements endangered species enhancement

Thinning pine stands for forest health

7. How many federal acres have been treated?

States reported treated 54,032 acres of federal land to date.....about 406 acres per project.

8. How many associated private or state acres were involved?

There were an additional 8700 acres of state or private land treated.

9. How many federal dollars were used by your agency to implement the project(s)?

So far, \$5,988,500 federal dollars were reported spent by state agencies, for an average of \$45,026 per project.

10. How many state dollars were used?

In addition, states spent \$2,893,118 of their dollars....though state dollars were not reported as spent on every project.

11. If you utilized other funds, please specify the amount and identify the source:

We are currently engaging two mills to provide in-kind work to get a minimal amount of road construction (\$20,000 to 30,000) complete so we will be able to use GNA for a sale.

Funds to work on establishing the Master Agreement and SPAs were from a Challenge Cost Share Agreement with State and Private Forestry for Tongass National Forest plan and transition from old growth to young growth work. Field work for the timber sales will be reimbursed, so we are using state funds to do this work.
Total acreage treated: >12,000 acres

Three Forest Industry partners have pledged \$200,000/year for a 3-5 year period. They provided an additional \$59000 in year one so IDL could purchase vehicles and computers for GNA staff.

USDA Forest Service, Dakota Prairie Grasslands - noncash contribution - \$15,660.

12. Were commercial harvests on federal lands involved?

YES – 11 NO – 8 NO ANSWER – 8

13. Was Stewardship Contracting involved?

Only 1 indicated that Stewardship Contracting was involved.

14. What other projects besides vegetative management were involved?

Increased community safety, job creation, and landscape resilience.

Trail work

Identification of invasive plant locations and species on federal lands and adjacent state lands, as well as invasive plant eradication in the high-elevation alpine zone.

None- this was a timber sale straight up. There was some road maintenance work as part of the sale.

Timber cruising, marking, boundary establishment, contract development and administration, project design (with oversight by the FS). IDL is adding NEPA planning capacity by hiring contractors to perform data collection and analysis with oversight by the FS.

Yes. Brush Disposal in the form of piling will be included as part of one of the agreements currently underway.

Taking inventory plots to provide data in order to begin other work.

The project is awarded but not implemented at this time we are not sure on this yet. What we are expecting is increased water quality and erosion control, noxious weed abatement, and community education and wildfire protection planning.

Other project accomplishments include cooperative landscape planning, optimal and efficient use of funding and resources, joint environmental compliance and improved communication between agencies and local cooperators.

pile burning, roadside & other hazard tree

Forest Health, Fire, Recreation

None to date. Probably starting in 2019.

Enhancement of state staff's experience and skill sets related to timber sale prep and administration.

Stand evaluation

15. Have you encountered issues that have prevented the project from being successful or effective?

It has been very difficult to get USFS to see GNA as a priority. Our staff has had to do much of the work to initiate discussions, meetings, and progress on developing SPAs. Also, it has been very difficult in finding a project that has potential to produce program income and can be done without road construction or reconstruction.

Just signed in September 2017 and have not initiated a project to date.

Some of the proposed projects have been delayed due to local (i.e. county) issues not originally anticipated. Also, lack of local collaboration and social license to do certain forestry treatments in some areas have delayed some potential Supplemental Project Agreements.

lack of understanding on the part of federal staff as to what is GNA what isn't
We are using a federal grant as "seed" money to get the program started by using a

shared forester position that works on both federal and state lands. However, because the federal grant has an end date (basically a term position) it has been hard to keep a person in that position as they apply for other permanent jobs, so turnover has been an issue. WE are hoping to get the position to be self-funded in the future through timber sale proceeds.

None to date. If the DOF didn't have the CCSA in place, we would have found it difficult to do the upfront work on development of the Master Agreement and SPAs. very successful, but have had to redirect effort toward GNA and identify staff specifically for these efforts; Requires good communication and interest by both state and forest service

To date, we have had a very positive experience partnering with the FS to implement GNA in Idaho. Two timber harvest projects are in progress, and there have been no significant issues. The most significant challenge is inability to include road construction/reconstruction in our projects. This issue limits the utility of GNA in two ways: 1. It limits opportunities for GNA commercial timber sale restoration projects since some degree of road reconstruction is almost always required to rehabilitate FS roads to suitable hauling standards. 2. It prohibits the use of potentially millions of dollars in Idaho GNA program income which could be spent on maintenance of existing FS roads thereby reducing sedimentation and enhancing water quality and aquatic habitat. In the short term, Forests are attempting to complete road reconstruction in advance of GNA timber sales using public works contracts.

There are a few overarching challenges with successfully implementing the GNA across different forests. Specifically, the alignment of a number of different groups who have input into seeing a project actual take shape and executed. From USFS district level staff and state field staff, to leadership at the forest supervisor's level and equivalent state manager level, broad agreement and support is crucial for successful selection and execution of a project. This extends to external stakeholders as well on both industry and conservation sides of the aisle. The perspective of the use and benefit of GNA varies widely from forest to forest, ranging from total agreement to seeing no use at all. This creates a unique challenge for state managers who must develop a diverse campaign to address these perspectives. The concept of "additive" in WA is also a component of the GNA that is a challenge. In WA, we are choosing to implement the GNA while not impacting our current state of business, therefore work associated with the GNA becomes difficult at the initial stages due the additional workload. The federal language translation and learning processes involved for state employees, as well as finding current staff who have the right mindset also capacity to undertake new work present other challenges.

Not to date.

No.

no

No.

Environmental compliance can result in project implementation delays and funding availability can prevent implementation. Both may have an impact on where projects are developed. There is no current definition of "incidental" to explain or define to what extent private lands affiliated with federal lands may be treated. The GNA doesn't allow federal resources (crews or equipment) to access state/private lands. In CA we have used the Wyden authority to allow federal resources access to state/private lands. Combined both authorities act to blend jurisdictional boundaries and optimize resource use.
lack of industry, so can't pursue timber management

Inaccurate FS forest inventory data.

We have just started the process. To date, only ~20 hours of labor have been performed but no issues up to this point.

no

16. Have you encountered legal issues because of state laws/rules?

Yes, some of the federal verbiage from the Supplemental Project Agreement templates did not "fit" with our state/university contracting procedures. These have all been or are being resolved with our US Forest Service partners at all levels (district, forest, and regional).

statutory issues preventing us from hiring staff even if we have the money

None to date. We're learning with every project we engage, so this would be a great question to ask again in a year.

In Washington, the State Environmental Protection Act, or SEPA, is a topic that we have been exploring with our legal advisors. This is an ongoing discussion as to whether the State should trigger SEPA for actions on federal lands, with federal decisions.

No state law issues were identified in developing GNA projects. For Wyden Authority agreements, it was unclear if Federal resources could access multiple state/private properties under one agreement.

Yes, state did not have authority to "work" on federal lands.

17. What solutions would you propose for addressing any of the identified issues?

Support the Good Neighbor Authority Improvement Act to remove the prohibition on road construction and road reconstruction. We very much need leadership within the USFS Region to make this a priority for the various Forests and to dedicate planning time and resources to making these projects possible on their respective work units.

Developing improved and open communication between all administrative levels in all involved organizations. Other levels and types of government (local, other state, etc.) may have to become involved at earlier junctures than originally anticipated. For one of the more complicated projects (involving multiple SPAs) we have instituted a periodic steering committee conference call. GNA program managers may also have to become involved with local collaboratives in order to communicate program objectives and procedures.

utilizing other partners to fill needed positions

Unknown at this time.

Ensure there is a mechanism for funding the upfront work necessary for such agreements. Our state is experiencing a fiscal downturn and it is very difficult to get new funding to do work. Without a federal funding source upfront, this project would not have happened.

* Congressional fix needed for GNA roads issue. * The 10 year term of GNA agreements is another important limitation that needs to be addressed at the congressional level. Idaho's Master GNA agreement expires in 2026. At that time all SPAs will also expire regardless of when each agreement was originally signed. Upon expiration all unspent program income must be returned to the US Treasury. This will not provide enough time to use all of the program income that has been generated since we expect ongoing GNA timber sales over the course of the 10 year agreement. IDL is exploring ways around this problem such as entering into a FS-1500-36 "Stand Alone" GNA agreement. Ideally this issue will be addressed in the 2018 Farm Bill by increasing the term of GNA Master Agreements or by allowing perpetual extensions thereby extending the SPAs.

Opportunities to create broad outreach have been effective to communicate how the GNA works. Often, due to the familiarity of Stewardship contracting, comparing GNA to the Stewardship authority can create an immediate understanding of both its ability and inability to accomplish work. Development of consistent guidance and messaging between states, at the state level, on what the authority can and cannot do, combined with the support of the Regional and Washington USFS offices will help to alleviate the disparate opinions on if forests should engage in GNA. Currently, it is almost fully dependent on the state's efforts to initiate projects across the state. There are forests with innovative leadership who actively engage which is often an important component of the alignment needed to successfully implement a project. Creating full-time, dedicated positions for GNA will be critical moving forward. However, this is directly dependent on the development of a federal project queue. A diverse understanding of what the GNA can do and properly communicated, should allow for development of these project lists.

To resolve the issue, the state acted as the liaison with private landowners to gain access rights. The state access agreements were then referenced in the Wyden Authority agreement.

Legislature passed an Act allowing PA to work on federal lands. Signed by Governor.

Now conducting stand examination as part of some GNA projects.

Conclusion

- Engagement in the Good Neighbor Authority seems to be increasing and should do so even more as several states have indicated an interest in getting involved in the future.
- Project objectives have been wide ranging.
- Commercial timber harvests are common components, but not Stewardship Contracting.
- Some more education on what it is and how it works would probably be useful.
- There are several suggestions for improvement and a few state issues to address, but overall most seem to be getting the authority to work.

