AIR QUALITY IMPACTS OF WILDFIRES: PERSPECTIVES OF KEY STAKEHOLDERS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT

OF THE

COMMITTEE ON ENERGY AND COMMERCE

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[1] The information can be found at: *http://docs.house.gov/meetings/if/if18/20171004/106463/hhrg-115-if18-20171004-sd007.pdf*.

AIR QUALITY IMPACTS OF WILDFIRES: PERSPECTIVES OF KEY STAKEHOLDERS

WEDNESDAY, OCTOBER 4, 2017

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENVIRONMENT,
COMMITTEE ON ENERGY AND COMMERCE
Washington, DC.

The subcommittee met, pursuant to call, at 10:01 a.m., in room 2123, Rayburn House Office Building, Hon. John Shimkus (chairman of the subcommittee) presiding.

Present: Representatives Shimkus, McKinley, Harper, Olson, Johnson, Flores, Hudson, Walberg, Carter, Walden (ex officio), Tonko, Ruiz, Peters, Green, DeGette, Cárdenas, Dingell, Matsui, and Pallone (ex officio).

Also Present: Representatives Schrader and McMorris Rodgers.

Staff Present: Ray Baum, Staff Director; Mike Bloomquist, Deputy Staff Director; Allie Bury, Legislative Clerk, Energy/Environment; Kelly Collins, Staff Assistant; Zachary Dareshori, Staff Assistant; Wyatt Ellertson, Research Associate, Energy/Environment; Tom Hassenboehler, Chief Counsel, Energy/Environment; Jordan Haverly, Policy Coordinator, Environment; A.T. Johnston, Senior Policy Advisor, Energy; Ben Lieberman, Senior Counsel, Energy; Mary Martin, Deputy Chief Counsel, Energy/Environment; Drew McDowell, Executive Assistant; Katie McKeogh, Press Assistant; Annelise Rickert, Counsel, Energy; Dan Schneider, Press Secretary; Peter Spencer, Professional Staff Member, Energy; Jason Stanek, Senior Counsel, Energy; Hamlin Wade, Special Advisor, External Affairs; Jeff Carroll, Minority Staff Director; Jean Fruci, Minority Policy Advisor, Energy/Environment; Caitlin Haberman, Minority Professional Staff Member; Rick Kessler, Minority Senior Advisor and Staff Director, Energy/Environment; Alexander Ratner, Minority Policy Analyst; Andrew Souvall, Minority Director of Communications, Outreach, and Member Services; and C.J. Young, Minority Press Secretary.

OPENING STATEMENT OF HON. JOHN SHIMKUS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SHIMKUS. The Subcommittee on Environment will now come to order.

The chair recognizes himself for 5 minutes for an opening statement.

First of all, actually, even before I start, we are also going to be joined by two of my colleagues from other subcommittees: Con-

gressman Schrader from Oregon; I think Cathy McMorris Rodgers from Washington State is also going to come.

By the rules of the committee, they are not allowed opening statements. They can ask questions once all the members of the subcommittee have. They are both from the great Northwest, along with the chairman of the full committee. So we look forward to their participation, and we welcome them to the subcommittee.

This subcommittee has jurisdiction over the Clean Air Act, and, for that reason, we frequently hold hearings about EPA regulations and policies designed to address air pollution. Today, we will address a source of air pollution so bad that it accounts for some of the Nation's worst air quality episodes, and that is the wildfires occurring across the U.S., especially out West.

While most of the focus during and after these fires is on the ecological and economic harm and the loss of life, the public health impacts from these wildfire air emissions also deserve congressional attention.

The statistics are staggering. So far this year, there have been almost 49,000 wildfires in the United States, destroying nearly 8.5 million acres. And the emissions from these fires can have serious impacts on air quality over a range that can stretch for many miles. As a result, millions of Americans can be exposed to pollutants found in wildfire smoke, sometimes for extended periods of time.

Nearly every other significant source of combustion, from vehicles to power plants to factories, are subject to very stringent controls, but the emissions from wildfires are completely uncontrolled. Worst of all, the sharp increase in particulate matter emissions from wildfire smoke can contribute to eye and respiratory irritation, impaired lung function, bronchitis, and exacerbation of asthma, especially in vulnerable populations.

In looking for solutions to these wildfires and the resulting air quality impacts, it is important to note how much greater wildfire risks are on Federal lands as compared to state or private lands. Often the largest and most polluting fires originate or involve Federal lands. Many point to active management of state and private forests as a reason behind their relatively lower risk of catastrophic wildfires. There are a number of preventative measures that have a proven track record for reducing both the extent and severity of wildfires. Where these measures are used, we see a much lower risk.

I look forward to learning more about active management from our distinguished panel of forestry experts.

One successful forest management strategy is prescribed burns, in which small, deliberate fires are set that significantly reduce the risk of far more damaging wildfires later on. Unfortunately, at least in some places, government restrictions impeded the use of prescribed burns, due in part to concerns about their air emissions from them. But these restrictions may be counterproductive if prescribed burns help avoid much greater air emissions from wildfires.

These are the kinds of policies we need to review. Congress should be looking at any and all ways to address wildfires and their emissions and, most important of all, the policy measures that can help prevent or minimize wildfires in the first place.

With that, I am ending my opening statement, and, seeing no other colleague asking for the remaining time, I yield back mine.

And I now turn to the ranking member of the subcommittee, Mr. Tonko, for 5 minutes.

[The prepared statement of Mr. Shimkus follows:]

PREPARED STATEMENT OF HON. JOHN SHIMKUS

This subcommittee has jurisdiction over the Clean Air Act, and for that reason we frequently hold hearings about EPA regulations and policies designed to address air pollution. Today, we will discuss a source of air pollution so bad that it accounts for some of the nation's worst air quality episodes, and that is the wildfires occurring across the U.S. and especially out west. And while most of the focus during and after these fires is on the ecological and economic harm and the loss of life, the public health impacts from these wildfire air emissions also deserve Congressional attention.

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Nearly every other significant source of combustion—from vehicles to power plants to factories—are subject to very stringent controls. But the emissions from wildfires are completely uncontrolled. Worst of all are the sharp increases in particulate matter emissions from wildfire smoke, which can contribute to eye and respiratory irritation, impaired lung function, bronchitis, and exacerbation of asthma, especially in vulnerable populations.

In looking for solutions to these wildfires and the resulting air quality impacts, it is important to note how much greater wildfire risks are on federal lands as compared to state and private lands. Often, the largest and most polluting fires originate on or involve federal lands. Many point to active management of state and private forests as a big reason behind their relatively lower risk of catastrophic wildfires. There are a number of preventive measures that have a proven track record for reducing both the extent and severity of wildfires, and where these measures are used, we see a much lower risk. I look forward to learning more about active management from our distinguished panel of forestry experts.

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Congress should be looking at any and all ways to address wildfires and their air emissions, and most important of all, the policy measures that can help prevent or minimize wildfires in the first place. Thank you.

OPENING STATEMENT OF HON. PAUL TONKO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. TONKO. Thank you, Mr. Chair. Thank you for calling this important hearing.

Thank you to our witnesses for being here this morning. Gentlemen, thank you for making the effort. I appreciate the opportunity to hear more about wildfires and the serious air quality issues they are causing.

This year, there have been over 49,000 fires in the United States, which have burned approximately 8.5 million acres. 2017 has been the most expensive year for firefighting yet. The United States Forest Service has spent more than $2 billion. In addition to these tremendous costs, public health is also at risk. Smoke, which includes

particulate matter and carbon monoxide, is choking people in communities around the country, particularly out West.

As these forests burn, a significant amount of greenhouse gas pollution is also released. Undeniably, all of these issues have become increasingly worse in recent years, so this is an important hearing.

Many of my Democratic colleagues and I often speak about the dangers associated with poor air quality. And it is clear that wildfires pose significant health, ecological, and fiscal challenges.

Today, we will hear much about the consequences of these fires to both human health as well as forest health. We will also hear about the changing philosophies on forest management.

I know work is being done to promote forest management techniques, such as prescribed burns and other tools, to improve forest health and reduce the harm of smoke. To that end, EPA updated its Exceptional Events Rule to allow the pollution from prescribed fires to be considered exceptional as long as certain smoke management practices are followed.

But we would be remiss if we only discussed the consequences of wildfires while ignoring the driving cause of these increasingly numerous and severe disasters, that being climate change. The 2014 National Climate Assessment identified the relationship between climate and fire. Very plainly, it found that, "forests in the United States will be increasingly affected by large and intense fires that occur more frequently."

Atmospheric and oceanic warming, higher temperatures causing drier fuels and forests, changes to snow pack, and years of drought are already coalescing to increase the length and depth of fire season. This issue is not going away, and, in fact, climate change will continue to exacerbate the problem, so we cannot ignore the causes. I am sure that improved forest management can help mitigate some of the dangers and costs, but these bigger climate issues must be considered.

Our forests are capable of capturing and storing significant amounts of carbon, which can continue to reduce carbon pollution and help meet emissions reduction goals. Because forests provide opportunities to reduce future climate change by storing carbon, inevitably they must be part of our climate solution. But having more and more acres burn without addressing the underlying causes will only make our air quality and greenhouse gas pollution issues that much worse.

So I ask that we keep the causes in mind as we think about how to help ensure our fellow Americans are able to have the air quality they expect and deserve in order to live a healthy life.

With that, I again thank you, Mr. Chair, and yield back.

Mr. SHIMKUS. The gentleman yields back.

The chair now recognizes the chairman of the full committee, Mr. Walden from the State of Oregon, who is living this as we speak. And the chairman is recognized for 5 minutes.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. I thank the chairman, and I commend him and Mr. Tonko for your statements on this matter. And it is time that we looked at air quality as part of the overall mix.

Oregonians have been living with this problem in the rural West for years—smoke-clogged skies from catastrophic fires. Just this summer in my home State of Oregon, we watched as fires burned more than 678,000 acres. That is equivalent to two-thirds the size of Rhode Island. And over $340 million has been spent so far to fight those fires—state, local, Federal costs.

And you can see the impacts. I have a photo up here. Sue from Rogue River sent me this. This is what it looked like in her pasture during one of these fires. It is really dense smoke. You may think that is fog. That is smoke from a fire that burned more than 190,000 acres.

And what you have to understand is that didn't burn off in the morning. That was there probably for a month. This is what we are facing throughout the Northwest, throughout the West every summer. In these basins, the smoke settles in like that, and there it sits.

Across Oregon, schools were forced to close because the air quality was so bad they didn't want the children in the schools. Some high schools had to travel hours away for football games. The Mighty Oregon Ducks had to go over to the Oregon coast to practice because the air quality in Eugene was so bad. Annual community events, from the Sisters Folk Festival to the 30th anniversary of Cycle, Oregon, to Shakespeare plays in Ashland—all cancelled. Nine plays, $400,000 lost to the Shakespeare theater, just in nine plays.

That is just the direct cost. I can't tell you how many people I talked to who had health issues develop that never had them before, people that had to go see physicians or go to the hospital because the air quality was so bad.

We know that wildfires pour significant amounts of pollution into our air. And, according to the EPA, forest wildfires emitted an annual average of 105.5 millions tons of carbon dioxide into the United States between 2000 and 2005. And, in fact, in 2005 alone, wildfires resulted in more than 126 million tons of carbon dioxide emissions in the United States.

And in a fire that I remember, the 2002 Biscuit Fire in southwest Oregon, the carbon dioxide emitted during that fire amounted to almost one-quarter of the total of carbon dioxide emitted in Oregon for the entire year. So, to Mr. Tonko's point, this is a contributing factor to additional carbon and other pollutants in the atmosphere.

It doesn't have to be this way. Fuel loads continue to build up in our forests because of broken Federal forest policies that have led to a lack of management. As you can see in the next chart that we are going to put up, between 2011 and 2015, Federal forests in Oregon grew by 1.3 billion cubic feet. Of that, 9 percent was harvested; 29 percent, that represents how much timber died; and the remaining 62 percent, or 822 million cubic feet, remains as fuel for fire. The point is our forests are not static but our management is.

Reducing that fuel load reduces the severity of a fire and the emissions. In fact, a 2014 study by the Sierra Nevada Conservancy, the Nature Conservancy, and the Forest Service showed that fuel treatment projects can reduce size and intensity of fire between 30 and 76 percent. Treatment also reduces carbon emissions from these fires by up to 85 percent.

Now, we are always going to have fire, but we can reduce the risk and intensity through proper management. And when we do get fire, we must get in and clean up and replant. To our colleague's point, healthy, green forests sequester carbon. Old, dead, dying forests emit it. And forest fires do the worst in that respect. The forests are really our lungs, and we should restore forests that are destroyed by fire. In fact, a study by the Forest Service's Pacific Northwest Research Station found that younger growing stands of trees absorb more carbon than far older stands.

We also need to consider how we choose to fight fire and the impacts of letting fire burn within wilderness areas simply because of that management designation. I have had a lot of complaints from people I represent and people throughout Oregon who are concerned that part of the Forest Service policy is "let her burn." And that is because it is in a wildness area, and they are not supposed to use intensive forest fire practices.

I understand that, but my concern is, does that take into account what happens to people who have to suffer from the smoke from those fires? The communities in my district, like Grants Pass and Medford, that saw days on end of "very unhealthy," or worse air quality during the Chetco Bar Fire. That fire was spotted at a quarter of an acre on July 12 in wilderness. It has now burned 191,000 acres.

These decisions on how, when, and how aggressively to fight fire matter. They matter to our forests, to our habitat, to our watersheds, and to the air quality in our communities. So let's have less of this ash and less of the ruin and better air quality.

Mr. Chairman, I yield back. Thank you.

[The prepared statement of Mr. Walden follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Today, we're taking a long overdue look at an air quality issue that has affected Oregonians and those living across the rural West for years—smoked clogged skies from catastrophic wildfires. Just this summer in my home state of Oregon, we watched as fires burned more than 678,000 acres—equivalent to two-thirds the size of Rhode Island—and over $340 million has been spent—so far—to fight them.

And you can see the impacts. Sue, from Rogue River, sent me these pictures of what looks like fog on her pasture. In reality it's dense smoke from a fire that burned over 190,000 acres.

Across Oregon schools were forced to close because of smoke and poor air quality. Some high schools traveled hours away for football games, and my Oregon Ducks had to practice on the Oregon coast to get away from the smoke.

Annual community events, from the Sister's folk festival, to performances of the Britt Festival in Jacksonville and the famous Oregon Shakespeare Festival in Ashland were canceled. Communities have watched timber jobs disappear as more and more of our federal land has become locked up. Those same communities are now watching tourism dollars slip away as visitors stay away from the smoke.

In meetings across my district earlier this month, I heard similar stories in different communities of people that were finding themselves visiting a doctor, only to learn their respiratory challenges were a result of the smoke.

We know that wildfires pour significant amounts of pollution into our air. According to EPA, forest wildfires emitted an annual average of 105.5 million tons of car-

bon dioxide in the United States between 2000 and 2005. In 2005 alone, wildfires resulted in more than 126 million tons of carbon dioxide in the United States. And in a fire that I remember—the 2002 Biscuit Fire in southwest Oregon—the carbon dioxide emitted during that fire amounted to almost one-quarter of the total carbon dioxide emitted in Oregon that year.

It doesn't have to be this way. Fuel loads continue to build up in our forests because of broken federal forest policies that have led to a lack of management. As you can see in this chart, between 2011 and 2015 federal forests in Oregon grew by 1.3 billion cubic feet. Of that, only 9% was harvested, 29% dies, and the remaining 62%—or 822 million cubic feet remains as fuel for fires.

Reducing that fuel load reduces the severity of a fire and the emissions. A 2014 study by the Sierra Nevada Conservancy, The Nature Conservancy and the Forest Service, showed that fuel treatment projects can reduce the size and intensity of fire between 30 and 76 percent. Treatment also helps reduce carbon emissions from these fires by up to 85 percent.

Now, we're always going to have fires but we can reduce the risk and intensity through proper management. And when we do get fire, we must get in and clean up and replant. Just like private forest managers do. These forests are our lungs after all, and we should restore forests that are destroyed by fire. In fact, a study by the Forest Service's Pacific Northwest Research Station found that younger, growing stands of trees absorb more carbon than far older stands.

We also need to consider how we choose to fight fire, and the impacts of letting fires burn within wilderness—simply because of its management designation—on air quality.

For communities in my district like Grants Pass and Medford that saw days on end of "Very Unhealthy" or worse air quality during the Chetco Bar fire, which was spotted at ¼ of an acre on July 12th in wilderness, and has now burned over 191,000 acres, these decisions matter greatly.

There are plenty of questions to explore today and I look forward to exploring them a bit more depth over the course of this hearing.

Mr. SHIMKUS. The gentleman yields back his time.

The chair now recognizes the ranking member of the full committee, Mr. Pallone from New Jersey, for 5 minutes.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Mr. Chairman.

This year has been a terrible year for natural disasters. Record numbers of wildfires and catastrophic hurricanes have claimed lives and property across the country and in the U.S. territories, and the human and financial costs of these events are extremely high and still rising. Recovery takes years, and some places never fully recover.

Climate change, in my opinion, is having the effects that were anticipated by the scientific community, and yet the Trump administration and the congressional Republican leadership continue to stick their heads in the sand. And they do so at all of our peril.

It is long past time for us to deal with the realities and risks we face due to the change in climate. We need to do a much better job of protecting communities by making them more resistant and resilient to natural disasters, and we need to slow the pace of climate change. And we need to adapt to the changes that we are facing.

All of this is critical, and it simply cannot be done until the Republican leadership actually acknowledges that it is indeed a problem. One would hope that the hurricanes and fires of the recent months have served as a wake-up call for some of my Republican colleagues, and we will see.

Now, turning to wildfires, I expect all of our witnesses today will point out that fire is and always has been part of the lifecycle of forests. In fact, many ecosystems are well-adapted to fire. Some systems require periodic burning to remain healthy to regenerate. In fact, some of the problems we are experiencing today are the unfortunate result of having suppressed fires in these systems for too long.

But severe drought, high seasonal temperatures, expansion of native pest species, and the introduction of invasive species also play a role. Climate change coupled with the buildup of brush, small trees, and other forest fuels has resulted in more frequent fires that burn hotter over more extensive areas.

The Forest Service recently announced that the firefighting costs for this season have exceeded $2 billion, and we haven't yet reached the end of the fire season. The costs for firefighting have been climbing, and if we do not change our management of these systems and invest more in preventative management, we can expect the costs to continue to grow.

But proper management does not mean simply increasing timber harvests. Logging does not prevent wildfires or minimize the impact when fires start. We need comprehensive ecosystem management that includes prescribed fires, selective harvesting, and reforestation. And we need greater public education, involvement, and participation, especially by communities living near and around forests to help them reduce their fire risk.

This hearing will highlight the air quality problems associated with wildfires. Smoke from those fires contains particulate matter, carbon monoxide, and other harmful gasses. It is a serious health hazard, particularly for those who suffer from asthma and other respiratory diseases, and it is a significant threat for the firefighters who respond and spend weeks fighting to control and put out the blaze.

The intense smoke also adversely affects visibility across large areas—we saw a picture that our chairman put up—and that impacts transportation, recreation, and tourism. Longer, more intense fire seasons expose many people in these areas to months of poor air quality.

Forests are a great resource. They provide tremendous economic and ecological benefits. They protect water quality, provide raw materials, and they support numerous recreation and economic activities. They are home to a diverse array of plants and animals. And these systems are among the most effective at absorbing and storing the excessive carbon we continue to pump into the atmosphere.

So, managed properly, they will continue to provide a full array of benefits, though we must acknowledge and respond to the threat that climate change presents to these systems and the communities that live near them.

I would like to yield the remaining minute to Mr. Schrader, my colleague from Oregon.

Mr. SCHRADER. Well, thank you very much, Mr. Chairman.

I think I have a slide I would like to put up on the screen too.

Wildfire treatment and forest management must work hand-in-glove together. The Eagle Creek Fire, burning close to Portland, ba-

sically devastated our iconic Columbia River Gorge, denuding popular and previously spectacular hiking trails that now will not be available for years to come.

But there is a more dangerous and insidious problem in our Federal forests that has gone almost completely unnoticed. That is the carbon emissions from dead and diseased trees in our forests. According to the Oregon Global Warming Commission, Oregon's forests are responsible for 75 percent of all long-term emissions produced statewide by all other sectors. And the bulk of that is from tree mortality, not just wildfires.

More chilling yet, although Federal forests occupy 50 percent of Oregon's forests, they account for 70 percent of yearly emissions due to tree mortality, while private forests only occupy 33 percent of state forestland and emit 16 percent due to tree death.

Active forest management is essential to preventing harmful ozone-depleting emissions. And, fortunately, there is legislation being developed to put healthy forest stewardship back into our neglected national forest treasures.

I look forward to the panel today. Thank you. And I yield back.

Mr. SHIMKUS. The gentleman's time has expired.

We now conclude with members' opening statements. The chair will——

Mr. WALDEN. Mr. Chairman, a point of order, just for a second.

That photo, by the way, is about 10 miles from where I live, that he had up there, in the gorge. That is the scenic Columbia River Gorge, national scenic area.

That fire burned 14 miles in one night, headed toward Portland when the winds were blowing. Then it shifted and came toward where I live. So they had to shut down barge traffic on the Columbia River—first time, I think, in history. That is the mighty Columbia River. And the railroads and the freeway were all shut down.

So thank you for the indulgence.

Mr. SHIMKUS. Without objection. Obviously, it is a catastrophe, and we appreciate the adding to the photos with the real-life observations and the concerns, and part of the reason why we are here today.

We have now concluded with members' opening statements. The chair would like to remind members that, pursuant to committee rules, all members' opening statements will be made part of the record.

We want to thank our witnesses for being here today and taking the time to testify before the subcommittee.

Today's witnesses have the opportunity to give opening statements, followed by a round of questions from our members.

Your full statements have been submitted for the record. We usually go about 5 minutes. As you see, this is not a highly contentious, controversial, mean-spirited hearing, so if you go over, that is going to be cool. But just don't go too long over the 5 minutes, because yes, then it will become contentious by members.

I will introduce you one at a time as you give your opening statements.

And, with that, I would like to first start with Mr. John Bailey, Professor at Oregon State University, College of Forestry.

Again, your full statement has been submitted for the record. You have 5 minutes. Welcome.

STATEMENTS OF JOHN BAILEY, PROFESSOR, OREGON STATE UNIVERSITY, COLLEGE OF FORESTRY; JIM KARELS, STATE FORESTER, STATE OF FLORIDA; KNOX MARSHALL, VICE PRESIDENT OF RESOURCES, MURPHY COMPANY; AND CHRISTOPHER TOPIK, DIRECTOR, RESTORING AMERICAS FOREST, THE NATURE CONSERVANCY

STATEMENT OF JOHN BAILEY

Mr. BAILEY. Thanks for the opportunity to address this subcommittee and generally talk about these important topics.

And beyond my background and the research in teaching, in fire, my basic philosophy is research, curiosity, education, social engagement, and commonsense solutions. And I think this is an example where we can really make progress on that.

I am going to make six points today.

The first, and it has come up, that the wildfire and associated smoke is just inevitable. And it was mentioned that these systems have evolved with fire, and it is just part of the Western world. And so we have to be careful about complaining about the numbers of acres and numbers of fires, because it is inevitable and these systems burn. And really what the issue is about the uncharacteristic behavior and the fuel accumulations and those kinds of things that we have out there right now.

I am sorry that my predecessors created that illusion, that fire was somehow un-normal and destructive and catastrophic. Some of that was our own fault, with Smokey Bear. Some of it we can blame on Walt Disney and Bambi. But whatever the reason is, we have to update our thinking on what is the role of fire out there.

And, fortunately, we have a lot of available science and technology and research to continue looking at these issues and help us regain, you know, some ability to view and manage fire as a natural part of the system. And that will have impacts on our human communities and air quality.

And one of the changes I definitely want to make in the light of climate change is, rather than repeating that our policy is suppression, we need to just get that word, "attempt" suppression, in there all the time, because these wildfires are inevitable.

Number two has already been mentioned. 2017 has been an impressive year. It will set some records, but all the numbers are not in yet. And it is the collision of climate and the accumulated fuels that have been referenced. We have an unprecedented amount of fuels on many, many of our acres out there. And what is a bigger concern for these large fires and landscape-level fire is that those acres are better connected than they have ever been, and fire flows across the landscape much like water.

So these are unprecedented conditions. Our ancestors would not have feared these climate conditions unless they would have had these kinds of fuel conditions. And so we have to view them together and treat them together.

Number three, holding to our current course and hoping that this is going to get better on its own would be a terrible mistake to

make. And remember that part of the definition of "insanity" is to keep doing the same thing and expect a different outcome. In fact, there is a pathological side to this, where doing things like 100-percent suppression or 100-percent attempting suppress actually makes the problem worse in the long run. And so we don't need to keep doing things that we know are making it worse.

Number four, this is a complex issue. It has already been mentioned that we can't just log our way out of this. This needs to be a comprehensive view. Our forests are scenery. As we saw, they are wild areas, they are recreational opportunities, they are watersheds that protect our water supply and fish. These hillsides are wildlife habitat. Yes, they are timber, they are fiber, they are carbon, they are ecosystems, and there are things that we haven't even thought about yet.

But they are also fuel. And when I look at them, I see fuel. And we need to think about them as fuel, and they are going to burn. Sustainable forest management, as we have talked about, ecosystem management, will yield, plenty of fiber and wood to meet the needs of society and the planet, and that is fine. In fact, in the near term, we have a backlog that we can remove from our hillsides.

Number five, a lot of the biomass is actually fine fuel. And that is going to be the role of prescribed burning, because that is about the only way to get rid of that fuel accumulation that is out there on the landscape. And that is a wonderful tool that we have. And using fire to limit future fire is an age-old proposition and approach. And it is much like vaccination; we can vaccinate our landscapes by using good, sound management, including prescribed fire.

And, finally, number six, we are straddled with a legacy of accumulated outdated thinking as much as accumulated fuels for this. And like our views on fire, also logging, and our old thoughts about timber battles and all—we have to get beyond the idea that preservation works in any meaningful way. These are dynamic systems, like I mentioned, that are going to burn. So we can't just set them aside and let them do their own things.

The good news is there are abundant win-win-win situations that we can move forward with. And the forestry profession and Oregon State University forestry will contribute to that as best we can.

[The prepared statement of Mr. Bailey follows:]

Testimony of

Dr. John D. Bailey

Professor of Silviculture and Fire Management

Oregon State University, College of Forestry

Before the Subcommittee on Environment

"Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders"

October 4, 2017

Thank you for the opportunity to give testimony on the linkages between air quality, wildland fire and active forest management. Wildland fire is one of the most pressing challenges affecting federa land management in the western United States. While complex, there are straightforward science-basec forest management approaches that can be taken to address this challenge taking human impacts, like air quality, into consideration. My name is John Bailey, and I'm a professor at Oregon State University, currently as the Maybelle Clark MacDonald endowed chair in the College of Forestry. My career in research and teaching includes the southwestern U.S. and, most recently, Oregon. My work has focusec on silviculture, or tree growing, forest restoration and management, and fire as wildland fire and prescribed burning. I am a 35-year member of the Society of American Foresters, since I was a student and firefighter at Virginia Tech. Beyond being a professor and a scientist heavily engaged in these topics, I am a long time forester, a father, and a concerned resident of Oregon who cares about public land management and air quality. My testimony today represent my opinion based on my knowledge and experiences. It will underscore the recognition that wildfire is inevitable, but available science can inform sustainable forest management practices that reflect broad land-management objectives and help us regain some control over when and how our forests burn.

The year 2017 has been another impressive year for wildland fire in Oregon and the West. The region is experiencing a recent trend for large acreages of large fires that alter our landscapes in ways we often do not like and that cost us billions of dollars in attempted fire suppression and subsequent fire management. While there is significant annual variability in fire seasons (meaning where and when forests are dry and fires are actually ignited) that makes it difficult to describe this trend, our average acreages and expenses for the last 15 years is now greater than the maximums seen in the previous decades. More than half of the last 15 years have been record years for wildland fire, costs of suppression, and smoke emissions. Local and regional air quality data supports this trend, particularly for communities like Sisters, Bend, Medford and Ashland in Oregon. And while air quality is a regular concern for many, this year's heavy smoke into the Portland metro area from the Eagle Creek fire has catalyzed many Oregonians into action on this issue.

This issue is about climate patterns and accumulated fuels.

Weather and fuels form two sides of the fire behavior triangle – topography is the third but is only the "surface" for weather and fuels. Weather has to be understood and regularly monitored from the perspective of fire managers; fuels have to not only be understood and monitored, but can be actively managed! Recent patterns in atmospheric and oceanographic warming, snow pack depths and longevity, and drought have all combined to increase the length of fire seasons – and these burning conditions and chances for ignition have now combined with an unprecedented amount of fuel on the landscape, particularly federal lands, to now stretch our fire management services beyond their capabilities. Most climate modeling projects continued lengthening and deepening of fire seasons based primarily on higher temperatures and resultant drier fuels in the forests, which strongly suggests that wildland fire will continue to be major issue at least in Oregon and the West. Combined with increasing amounts of fuel on the landscape, both in terms of the total quantity on many acres and the

connectivity between those acres, the stage is set for continued increases in large wildfires that burn increasing large areas at high severity.

This increase in large wildfires will have significant impacts on the ecology of many forest types across the West, but they are impacts from which forests can recover particularly if we can moderate the fire behavior with our management practices. Further, there are potentially crippling effects on economies and human communities, including fatalities in the workforce and general public. For example, the Douglas Complex fire in southern Oregon and Canyon Creek Complex fire near John Day are two examples of tens of thousands of acres of forest uncharacteristically burned, having impacts on wood volume availability and forest sector activity, millions of dollars spent of relatively ineffective suppression activities, community evacuations based on the advancing fire and smoke (with associated human health costs), hundreds of homes and other buildings/property destroyed, local and regional economies reworked, and lingering impacts to communities as they recover and rebuild. And both fires had human casualties. The Eagle Creek fire this year, still burning, has altered the Columbia Gorge landscape, required evacuations, closed down the tourism economic engine for that area for most of a month, threatened historic landmarks, cost us millions of dollars in attempted fire suppression and fire management, and will likely cost more millions in rehabilitation and restoration. At least everyone went home from that fire, and Portland has healthy air once again.

But holding to our current course, steadfast in our inattention and inaction on this issue, will only mean that there are many more large and negative wildfires to come. We as a society don't have to just let it happen. My research along with others nationally and internationally attempts to advance our understanding of fire ecology, fire science and management, prescribed fire and thereby change the wildland fire management system and the landscape. This work goes well beyond grants and publications and students; I believe we are approaching a crises that will propel us into a whole new way

of managing our lands sustainably and adaptively in the face of changing climate. I want to prepare the next generation to deal with that, and I need your help to do it.

More active land management with an eye to fuels management.

Our wonderful forest landscapes are more than trees and logs. We cannot reduce this issue to logging – we cannot log our way to success. Our forests are scenery, wild areas, recreational opportunities, watersheds for our fish and ourselves, wildlife habitat, wood for timber and fiber, carbon, biomass, ecosystems, and FUEL. Forests are all these things, and most all of our forests is fuel. Most western ecosystems evolved with fire as an integral process, which limited the accumulation of fuel. Our ancestors on these lands used fire as a tool, managed their lands and considered the fuels. We can and should manage our lands sustainably as fuel.

More prescribed fire before wildland fires and during wildland fires.

The solution to unwanted wildfire behavior is *NOT* to pressure young men and women to take more risks by using more aggressive tactics on the fireline and more expensive technology attempting to suppress fire. The solution is to harness the expertise and dedication of federal, state, tribal, NGO, and private sector fire managers to use active and sustainable forest management today, including fire as one of the tools, to help mitigate the effects of future fires. There are opportunities every year to remove and alter the fuels on the landscape and to use prescribed fire and natural ignitions to burn more than a century's worth of accumulated fuels. Using fire under milder weather conditions is not without risk because it is impossible to predict fire behavior with precision. But increasing the tempo and scale of active management and burning under more favorable weather will help reduce the inherent and ever-present risk of wildfire more than relying entirely on a failed suppression model as the first, last, and only line of defense against conflagrations.

Events like the Douglas and Canyon Creek Complex fires have many causes, but the most critical mistake was the Forest Service's inability to treat (i.e. burn) surface fuels years before these fires. The Eagle Creek fire burned like it did last month because of decades of choices to not alter the fuels, including choices to suppress fire even on good days for burning. This was not a failure by the Forest Service personnel - it was a failure of regulation that gave greater weight to mild smoke impacts in the near term over massive smoke impacts in the long term. It was a failure of Congress in not funding fuel reduction at the same level they fund suppression. It was a failure of media outlets in perpetuating the myth that all wildfires can and should be extinguished. And it was a failure of society to pay attention to the emerging problems.

More uncharacteristic wildland fire is inevitable until these problems are addressed.

Wildland fire is as inevitable the weather, and hurricanes, and floods, and disease. So we, as a society, have preventative measures we can take: preparations and vaccinations of sorts. Like vaccinations and building our resistance to diseases, we build resistance to wildland fire **with fire**. Active land management including prescribed fire treatments will be essential to our ability to provide the wonderful range ecological and socioeconomic benefits of our forests; however, we are falling further and further behind in the implementation of treatments. This is particularly true in and around human communities, receptor areas where air quality is strictly regulated, and other highly valued areas of our forested landscapes. There are many groups working on revisions to smoke management rules that will allow "vaccination" – a little smoke when we can influence the amount and location in exchange for unregulated wildfire smoke. But there is regulatory resistance.

In conclusion, we are saddled with a legacy of outdated thinking in addition to accumulated fuels – and we are moving quickly into an uncertain climatic future. Wildfire is inevitable. Our forests will continue to burn regardless of what we say or do today. But we can better choose when and how it

burns, and how it can be consistent with broad land management objectives. There are abundant win-win-win situations at hand if we choose to act proactively and wisely. Thank you again for the opportunity to speak with you today.

One-page summary for Bailey testimony, October 4, 2017

Wildfire is inevitable; available science can inform sustainable forest management practices that reflect broad land-management objectives and help us regain some control over when and how our forests burn, with resultant impacts on the land, human communities and air quality.

The year 2017 has been another impressive year for wildland fire in Oregon and the West. Climate change combined with increasing amounts of fuel on the landscape, both in terms of the total quantity on many acres and the connectivity between those acres, and set the stage for continued increases in large wildfires that burn increasing large areas at high severity.

Holding to our current course, steadfast in our inattention and inaction, will only mean that there are many more large and negative wildfires to come. We as a society don't have to just let it happen.

Our wonderful forest landscapes are more than trees and logs. We cannot simplify this issue to "logging" – we cannot log our way to success. Our forests are scenery, wild areas, recreational opportunities, watersheds for our fish and ourselves, wildlife habitat, wood for timber and fiber, carbon, biomass, ecosystems, and FUEL.

We need more prescribed fire before wildland fires and during wildland fires. Active land management including prescribed fire treatments and fire use will be essential to our ability to provide the wonderful range ecological and socioeconomic benefits of our forests; however, we are falling further and further behind in the implementation of treatments.

We are saddled with a legacy of outdated thinking in addition to accumulated fuels – and we are moving quickly into an uncertain climatic future. But we can choose when and how the forests burn, and how it impacts future generations. There are abundant win-win-win situations at hand if we choose to act proactively and wisely.

Mr. SHIMKUS. The gentleman yields back his time.

The chair now recognizes Jim Karels, State Forester from the State of Florida.

Welcome, sir.

STATEMENT OF JIM KARELS

Mr. KARELS. Thank you, Chairman Shimkus, Ranking Member Tonko, Full Committee Chair Walden, and members of the subcommittee. Thank you for the opportunity to testify before you today on this important issue of air quality and wildfires.

My name is Jim Karels. I am the state forester and director of the Florida Forest Service. And I am here today testifying on behalf of the National Association of State Foresters, of which I have been a past president, and I am the current Wildland Fire Committee chair. I have spent 36 years in the fire and forestry business across the country, and I am honored to share some of those experiences with you today.

NASF represents the directors of the state forestry agencies across the country. We deliver technical and financial assistance, along with wildfire and resource protection, on two-thirds of the 766 million acres of forest in this country.

We do that with support from the United States Forest Service, state and private forestry programs, and state and volunteer fire assistance grants, which provide equipment and training to the firefighters who respond to state and private land fires, where over 80 percent of the Nation's wildfires start.

As was mentioned, a very challenging year—49,000 fires, 8.5 million acres, with still more activity and potential in California for the fall and parts of the Southeast.

Florida was not immune to wildfire activity this year. Southwest Florida, in a span of 4 months this spring, evacuated 5,000 homes and inundated cities like Naples and Fort Myers and surrounding communities with smoke and air quality issues. And, at the same time, on the Georgia-Florida line, the 150,000-acre West Mims Fire impacted rural communities, natural resources, and air quality issues for cities as large as Jacksonville.

Fire is a natural part—well, let's back up, because I left out the West. The western states all summer long grabbed the headlines of the issue of smoke, hundreds of fires blanketing communities across the western U.S., with smoke endangering citizens and wildland firefighters and impacting, like I said, communities large and small.

Fire is a natural part of our ecosystem. There are beneficial fires. These fires thin our forests, they reduce the fuels, they improve the wildlife habitat, and they improve our forest health. However, we are seeing more and more of the catastrophic fires, like this summer, that are very costly and that produce a tremendous amount of air pollution.

While burning, forest produces numerous hazardous chemicals in its smoke plume. The pollutant of most concern is that particulate matter that was spoken of, microscopic particles, 2.5 microns in size, that penetrate deep into the lungs and cause breathing issues and negative issues on our health.

We know the effects of exposure of these particulate matter are felt most in our sensitive populations: our children, our elderly, and those that have existing conditions.

We know the effects of prolonged exposure is also a significant issue. Our bodies can eliminate this particulate matter during a 1- or 2-hour or even a 1- or 2-day process, but those prolonged events, weeks and months on end, as the Congressman said in Oregon and stuff, that has significant impact on your health, whether you are a citizen, whether you are a firefighter. And I can speak firsthand on experience of wildland fire safety and smoke later on, if wanted.

Wildfire smoke also has impacts on our communities in many ways beyond the simple human health. Tourism revenue suffers. Children suffer from the canceled outdoor events and the inability to recreate outside. Motorists face significant driving issues. Wildfire smoke is a major issue across our country.

So what do we do to address the issue of these mass amounts of wildfire smoke during the fire season? The state foresters believe wholly in prescribed fire during the right times of year and targeted hazardous fuel reduction projects.

With respect to prescribed fires, I mentioned it is part of our forest ecosystem. However, it is better that fire happens under that controlled system of a fire manager where we know the winds, we know the temperature, we have predetermined boundaries, and we are able to notify the public ahead of time, rather than this uncontrolled, catastrophic large fire. And those prescribed fires, many times, help to reduce the number of catastrophic fires in the future.

In Florida and across the country, we also engage in forest thinnings and targeted hazardous fuel removal for fire-resilient landscapes. We do that with our private landowners, we do that on our state forests, and we work with our U.S. Forest Service partners through the Good Neighbor Authority in Congress to reduce those fuels.

Once again, thank you for the opportunity to testify before you today, and I look forward to your questions.

[The prepared statement of Mr. Karels follows:]

Testimony of Jim Karels, Florida State Forester
On Behalf of The National Association of State Foresters

Submitted to the U.S. House Committee on Energy and Commerce,
Subcommittee on the Environment

For Hearing on
AIR QUALITY IMPACTS OF WILDFIRES:
PERSPECTIVES OF KEY STAKEHOLDERS

October 4, 2017

Good morning, Chairman Shimkus, Ranking Member Tonko, and Members of the subcommittee. My name is Jim Karels, State Forester and Director of the Florida Forest Service, as well as past President of the National Association of State Foresters (NASF) and current Chairman of the NASF Wildland Fire Committee. I appreciate the opportunity to speak with you today and submit written testimony as the Committee considers the significant impacts of wildfire smoke on citizens and communities across the country, as well as the preventive role prescribed fire and hazardous fuels reduction can have in mitigating smoke impacts.

The NASF represents the directors of the state forestry agencies in all 50 states, eight territories, and the District of Columbia. State Foresters deliver technical and financial assistance, along with protection from wildfire and protection of forest health, water, and other ecosystem services for more than two-thirds of our nation's 766 million acres of forests. Through the State Fire Assistance (SFA) and Volunteer Fire Assistance (VFA) programs, state agencies equip prescribed fire managers and wildfire initial attack resources for state and private lands, which represent over two-thirds of our nations forests and where over 80% of the nation's wildfires start.

In addition, state agencies work closely with our federal partners in managing complex multi-jurisdiction landscapes. We often say "fire knows no borders", and thus aim to carry out management and planning across ownerships. To this end, with the authority granted by Congress in the 2014 Farm Bill, over 30 states have signed "Good Neighbor" agreements with the federal government, including in my own state of Florida. These agreements allow states to help perform watershed restoration and forest management such as by addressing hazardous fuels on federal lands in critical fire risk areas.

While the duties of state agencies vary from state to state, all share common forest management and protection missions and most have statutory responsibilities to provide wildland fire protection on all lands, public and private. As such, we are intimately aware of the increasing occurrence of wildland fire and associated smoke impacts in nearly every state.

Summary of Regional Fire Activity

The fire season that is currently winding down has been one of the worst in recent memory. Nearly 50,000 fires have burned 8.4 million acres across our country since January 1, with significant fire activity still expected before the year is out in California and parts of the southeast. Federal fire suppression costs in Fiscal Year 2017 exceeded $2 Billion dollars for the Forest Service alone, not to mention the suppression expenses at the Department of the Interior, State Agencies, Volunteer Fire Departments, and other cooperators.

Last fall, we experienced a rash of large fires across the southeastern United States, including the Great Smoky Mountains wildfire complex in Tennessee that swept into Gatlinburg, taking the lives of 14 individuals and capturing the nation's attention for its intensity and smoke impacts.

In the spring of 2017, the West Mims fire in the Okefenokee swamps of Georgia and Florida burned for over two months, consuming over 150,000 acres and blanketing the region in smoke which impacted fire responders, local communities, motorists, and more. The spring also saw over 5,000 homes evacuated due to threats from wildfire in southwest Florida over a 4-month period, as well as hundreds of fires burning across the Southwestern US challenging firefighters early in the western fire season.

Despite a winter with significant snowfall which was expected to minimize the summer fire season, spring and summer droughts brought rampant wildfire to the Pacific Northwest and Rocky Mountain geographic regions this year as well. Significant fire activity in nearly every state brought to bear nearly every fire resource available in the country.

Over the past 12 months, there has been virtually no area of the country immune from wildfire incidents and the associated smoke impacts. This year has been particularly noteworthy, in that fires and their impacts have not been localized to the forest-based communities most experienced with living with fire. Large cities, often far from the forests on fire, have experienced significantly reduced air quality, impacting human health, community events, tourism, recreation, and much, much more.

Our Nations Forests and Wildfire

Fire is a natural phenomenon for nearly every forest ecosystem in this country. Fire has shaped the occurrence and distribution of different ecosystems for centuries, simultaneously impacting the human and natural communities that live in and around those forests. Over the past century, a culture of fire suppression has unfortunately removed the natural role of fire from the public consciousness; however, when combined with a reduced level of forest management in many areas of the country this culture has also led to the build-up of hazardous fuels to historic levels. Despite our attempts to manage away wildfire, our forests are currently as fire-prone as ever.

What Federal, State and local fire managers as well as scientists and researchers have learned over the past decades is the critical role of hazardous fuels management in mitigating wildfire impacts. Solely focusing on wildfire suppression and ignoring proactive forest management does not lead to the least amount of fire in the long run; the fuel continues to build up to the point where eventually wildfires become unmanageable under initial attack. The task for wildfire managers is to manage the risk to communities and ecosystem values in both the short-term and long-term by implementing a coordinated and science-based program of fuels reduction, fire suppression, and community planning. Where forests of different ownerships exist in close proximity to each other, it is critical that these decisions about suppression and fuels treatments get made in a collaborative and cooperative way. This is especially true for federal lands on which fire management has a direct impact to adjacent state and private lands and/or communities.

Hazardous fuels reduction has two main components; prescribed fire and silvicultural thinning. Both activities have a beneficial impact on mitigating wildfire emissions by reducing combustible material in the woods and allowing fire to play its natural role in the ecosystem. In many parts of the country, especially on federal lands which have not seen regular management, forest stands are too dense to conduct prescribed fire and thus forest thinning is a crucial first step in managing hazardous fuels. Subsequently, prescribed fire is an important tool to maintain the "investment" of a thinned and resilient forest, and to keep the likelihood of catastrophic wildfire at a low level.

Wildfire and Air Quality

The air quality impacts from forest fire smoke have long been scientifically documented. Of primary concern is particulate matter (PM), which is produced from the combustion of woody material. Specifically, particulate matter smaller than 2.5 microns (PM 2.5) is of concern for individuals exposed to wildfire smoke due to its ability to penetrate deep into the lungs and respiratory system. PM 2.5 can cause both short-term health effects such as eye, nose, throat and lung irritation, coughing and shortness of breath, as well as long-term effects on respiration and the worsening of medical conditions such as asthma and heart disease. Air quality impacts from wildfire often hit the hardest in sensitive populations (i.e. children, elderly and those with pre-existing conditions). In addition to human health, reduced air quality from wildfire smoke can impact tourism, recreation, education, and a variety of other aspects of community life.

The differing air quality impacts from prescribed fire compared to unplanned wildfire are important to recognize. One of the keys to prescribed fire for hazardous fuels management is

that it is done in seasons and under conditions where fire managers have the ability to control fire location, spread, intensity, and many other parameters. Weather forecasting and state-of-the-art smoke modeling software allow for fire managers to tailor ignition locations and times to meet smoke management objectives. While each state has different laws and regulations around burning permits and number of allowable burn days, fire managers work within these parameters and laws to manage a minimal amount of smoke now in avoidance of the potential for a much greater amount in the future.

The beneficial impact of managed prescribed fire on air quality emissions has been recognized by the US Environmental Protection Agency (EPA) in its rulemaking over the past two years. In both the updating of the National Ambient Air Quality Standard (NAAQS) for PM 2.5 (81 CFR 164, pg. 58010) and the updating of the Exceptional Events Rule (81 CFR 191, pg. 68216), the EPA clearly documents the role of wildfire as an emissions source and the relevance of prescribed fire use and fuels management to reduce the risk of catastrophic wildfire. It is becoming increasingly evident through science and experience that without prescribed fire and the small amount of managed smoke that comes with it, we are perpetuating the conditions that generate catastrophic air quality issues and put communities and individuals at risk.

State Examples of Managing Prescribed Fire for Air Quality

Despite the ecological and social diversity across our nation and the different forest management and wildfire challenges states face, there is a common effort among state foresters to focus on increasing the use of prescribed fire during favorable conditions in order to reduce the likelihood

of catastrophic fire and smoke from wildfire. I would like to share examples of two state efforts with you today.

Florida

Land managers in Florida have realized the benefits of prescribed fire in maintaining healthy ecosystems. As Florida's population rapidly increased in the latter half of the 20th century, it became necessary to address the impact prescribed burning had on air quality. In the late 1980s, the Florida Forest Service (FFS) developed the Certified Prescribed Burn Manger program to educate prescribed fire practitioners regarding their legal and good-neighbor responsibilities along with basic information on fire behavior, smoke management and other topics. In 1999 the FFS developed its first smoke management plan (SMP) approved by EPA. Florida's current SMP (dated 2014) was developed in conjunction with the Florida Department of Environmental Protection and the Florida Highway Patrol.

By following the guidelines in the SMP, Florida is able to conduct one of the largest prescribed burning programs in the nation. Each year the FFS authorizes an average of 2.3 million acres of silvicultural and agricultural burns with minimal impact on the state's 20 million residents. This is done using weather forecasts and sophisticated smoke models to determine the best days to conduct a burn while minimizing impacts from prescribed fire emissions.

Oregon

In Oregon, prescribed burning is utilized to meet a variety of land management goals, including hazardous fuel reduction. Annually, landowners, public and private, initiate approximately 3,000

prescribed burns on about 200,000 acres. Oregon has accomplished this effort with limited smoke impact to its communities, averaging only seven intrusions (visible ground level smoke) into its communities annually. Oregon's robust smoke management program provides a daily forecast utilized by burn managers to achieve its goal of maximizing burn opportunities while minimizing community impacts. In contrast, wildfires burn approximately 500,000 acres annually across the State, and as seen in recent years, wildfires present significant health and economic impacts. Like in most areas of the country, there is a recognition in Oregon that still more collaborative work needs to be done to increase the use of prescribed burning and reduce the potential for large catastrophic wildfires. To this end, Oregon is currently reviewing its smoke management program to balance risk of intrusions with reduced wildfire risk.

The Need to Fix Wildfire Funding

It is impossible to talk about managing for healthy, resilient forests, and reducing the number of catastrophic air quality events without mentioning the detrimental impacts of the current way of budgeting for wildfire suppression, and recognizing the critical need for change.

Today's fire seasons are on average 78 days longer than in the 1970s and are projected to grow hotter, more unpredictable, and more expensive in the coming years. When wildfire strikes, the funds used to combat these disasters come directly out of the budgets for the USDA Forest Service and the Department of the Interior Agencies. Over the last few decades, the USDA Forest Service budget for fire suppression has grown from less than 20 percent to more than 50 percent of the agency's total budget.

As wildfire eats up a significantly larger share of the agency's budget, critical funding that supports federal, state and private forests is also impacted. Those impacts include a decrease in the ability to thin forests to create more resilient conditions. Compounding the issue is a practice known as "fire borrowing", which occurs when the agency runs out of appropriated funding in a given year. Fire borrowing robs money from non-wildfire programs to pay for the current year's fire suppression needs.

America's forests urgently need a fix that will fund these catastrophic wildfires the same way other natural disasters are funded. On the heels of one of the worst fire seasons ever, State Foresters request Congress to urgently address this issue in a way that ends "fire borrowing" and also addresses the rising costs of suppression's impacts on other agency programs and budgets.

Conclusion

Thank you for the opportunity to appear before the Committee today on behalf of the National Association of State Foresters. Wildland fire response is one of the most challenging facets of our jobs. As State Foresters, we believe we need to be doing significantly more hazardous fuels reduction all across this country and are working towards this goal. Such treatments allow us to put fire on the landscape at times and under conditions that minimize impacts, including smoke emissions. These treatments reduce fuel loading in the forests so that when wildfires inevitably occur, they burn with less intensity, reduced spread and fewer smoke impacts on communities and firefighters.

Where forests of different ownerships exist in close proximity to each other, it is critical that decisions about suppression and fuels treatments get made in a collaborative and cooperative way. This is especially true for federal lands on which fire management has a direct impact to adjacent state and private lands and/or communities. We look forward to continuing our strong working relationships with the federal agencies, and to working with Congress to enable more good work to be done on the ground.

Mr. SHIMKUS. Thank you, sir. Thank you for your testimony.

Now we turn to Knox Marshall, Vice President of Resources, Murphy Company.

You are recognized for 5 minutes, sir.

STATEMENT OF KNOX MARSHALL

Mr. MARSHALL. Thank you.

Chairman Walden, Chairman Shimkus, and Ranking Member Tonko, thank you for the opportunity to testify here today on this very important issue.

As Congressman Walden and Congressman Schrader have pointed out, they have witnessed this firsthand. We appreciate their leadership on this important issue.

My name is Knox Marshall. I am Vice President of Murphy Company, located in Eugene, Oregon. We are a wood products manufacturer, and we rely on the forest for the wood products we need to support our business. We are deeply committed to the 750 people we employ and the communities where our operations are located.

These wildfires are having disastrous effects on our public forests, human health, and public safety. While many natural disasters are beyond our control, in the case of forest fires, we can use active forest management to reduce the size and the severity of these disasters and their impacts on direct air quality while, also, we can produce renewable, climate-friendly wood products used by Americans every day. A true win-win.

If the goal of our public policy is to have less toxic air, less carbon pollution, healthy watersheds, resilient forests, and sustainable wood products that create family-wage jobs in rural communities, we have to manage our forests now.

Chairman Walden noted some of the serious impacts to air quality and public health. My written testimony includes examples of what happened this year in Oregon and Washington when we were blanketed by smoke and ashes for the entire summer—the worst I can remember in my career, going back 25-plus years. Nationally, we set new records for the number of acres burned and the cost of fighting these wildfires. Not records anyone in this room probably wants to set.

Unfortunately, these trends will continue unless changes are made to our Federal forest management and our Federal forest fire suppression practices. There is an urgent need to address the root cause of worsening catastrophic wildfires. It is forest health. While we can't prevent all fires, science does tell us that we can reduce the size and severity of wildfires through active forest management, including timber harvesting, mechanical thinning, and prescribed fire.

Nearly a century of fire suppression and the more recent lack of active forest management of our Federal lands have resulted in overstocked forests that are the root cause of the mass mega-fires and the insect mortality we are seeing in Western forests. Where we once had 50 to 100 trees per acre, we now have 500 to 1,000-plus trees per acre. To that effect, it is no surprise that 60 million acres of Federal forestlands are at high risk to catastrophic wildfire.

Each year, Federal agencies are only able to mechanically treat about 200,000 acres, and we continue to fall further and further behind on this trajectory. It is also true that warming temperatures are exacerbating the forest health crisis, which is precisely why Federal agencies must act quickly to correct these overstocked forest conditions.

We need to take a smart, proactive approach to fighting wildfires, like the approach taken by many private and state forest managers. These mega-fires lead to massive emissions of CO_2. The reality is that responsible forest management and fire suppression will limit the emissions of CO_2 and sequester carbon in the wood products produced, used every day in construction of our homes.

I want to emphasize the need for Congress to give our Federal land management agencies new legal tools to reduce the time and cost required to plan forest management projects, particularly under the National Environmental Policy Act. It will also require smart legal reforms to discourage serial litigants who sue to delay and stop these projects.

I also personally have serious concerns, along with other forest managers in the West, about the growing risk to our own private forestlands. Lack of active management on neighboring Federal lands, in what we believe is a growing failure of the foresters to aggressively attack forest fires when they are small and highly capable of being extinguished, poses a severe risk to the assets that sustain our business that we have purchased. A lot of times, the fire lines have become the private property lines on these massive fires, because where the management has taken place becomes a natural firebreak.

The agency's current approach to fighting fires is imperiling much of the West and harming the air quality in a significant manner. The choice to let the fire burn needs to be thoroughly reviewed and utilized only in exceptional circumstances where the risk of fire growth is absolutely minimal and these ecological benefits are absolutely certain.

Absent any reform, state and private landowners need sufficient authority to perform initial attack suppression activities on Federal lands and/or the ability to hold Federal agencies liable for damages to the private lands from the fires that originate on Federal lands, similar to the liability we face as landowners if we have fires burn onto Federal lands.

Thank you, and I welcome the opportunity to answer any questions.

[The prepared statement of Mr. Marshall follows:]

TESTIMONY OF KNOX MARSHALL
BEFORE THE
HOUSE COMMITTEE ON ENERGY AND COMMERCE
SUBCOMMITTEE ON THE ENVIRONMENT

October 4, 2017

Chairman Walden, Chairman Shimkus, and Ranking Member Tonko, thank you for the opportunity to testify today before the Subcommittee about the serious impacts catastrophic wildfires are having on our environment and communities. Congressman Walden has seen this devastation first-hand and we appreciate his leadership. While many natural disasters are beyond our control, we can use active forest management to reduce the size and severity of these wildfires while also producing renewable, climate-friendly wood products used by Americans every day – a true win-win.

My name is Knox Marshall and I am the Vice President of the Resources Division at Murphy Company, a family-owned wood products manufacturer headquartered in Eugene, Oregon. Murphy Company is a long-time Oregon employer that dates back to 1909 and is presently led by CEO John Murphy, the grandson of one of our founders. We employ over 750 workers in family-wage jobs at four wood products manufacturing plants in Oregon and one in Washington. The Oregon facilities include a veneer plant in White City, softwood plywood plant in Rogue River, a hardwood plywood specialty plant in Eugene and a laminated veneer lumber ("LVL") facility in Sutherlin. In Washington, we own and operate a veneer plant in Elma to augment our supply of raw material for our Oregon facilities. In recent years, we've also invested in private forestlands to help meet our company's raw material needs.

In my more than 20 years in the wood products industry, I have never seen a wildfire season in Oregon that was as harmful to our communities as this 2017 season. Oregonians suffered through smoky conditions for weeks on end throughout much of the state, including

southern Oregon, the Willamette Valley and central Oregon. School days were curtailed, sporting events like Cycle Oregon cancelled, and events like the Britt Music Festival and the Oregon Shakespeare Festival saw dramatic declines in attendance or were cancelled.

A devastating fire in the Columbia River Gorge resulted in thick ash deposits throughout much of the Portland area, brought recreation in this National Scenic Area to a virtual halt for several weeks, and closed Interstate 84 for weeks to travel and commerce. For several days in September, Portland had the worst air quality in the nation. Beyond the eye and respiratory tract irritation, wildfire smoke is also responsible for more serious disorders, including reduced lung function, bronchitis, exacerbation of asthma, and premature death. Studies have found that fine particulate matter is linked (alone or with other pollutants) to increased mortality and aggravation of pre-existing respiratory and cardiovascular disease.

Active Management Needed to Restore Forest Health, Limit Catastrophic Wildfire.

Unless changes are made to our federal forest management and fire suppression practices, the terrible impacts to air quality, habitat, and communities inflicted by wildfires in 2017 will become the norm rather than the exception in future years. Aggressive action must be taken to address the root cause of the worsening catastrophic wildfires – poor forest health. While we can't (and shouldn't) prevent all fires, science does tell us that we can reduce the size and severity of wildfires through active forest management, including timber harvesting, mechanical thinning and prescribed fire.

Nearly a century of fire suppression and the more recent lack of active forest management on our federal lands have resulted in overstocked forests that are at the root cause of the massive megafires and insect mortality that we are experiencing now. For example, forests in California's Sierra Nevada once had 50-100 trees per acre, but now we see 500-1,000 trees per

acre. It is no surprise that over 60 million acres of national forestland are at a high risk of catastrophic wildfire. Each year we fall further behind as federal agencies are only able to mechanically treat a small percentage of the at-risk acres each year. In fact, in recent years mechanical harvests on our national forests have been limited to about 200,000 acres annually.

The statistics speak for themselves. Compared to the 1970s, our current wildfire seasons are an average of 78 days longer, are less predictable and are more catastrophic. This was a finding by the U.S. Forest Service. According to a recent study from the Oregon Forest Resources Institute, more than 350 million individual trees are standing dead in the 14 million acres of national forestland in Oregon. And in California, the epicenter of that state's bark beetle epidemic where an estimated 102 million trees have died is on national forests.

It is true that warming temperatures are exacerbating the forest health crisis, which is precisely why federal agencies must thin their overstocked forests to improve their resiliency and take a smart, proactive approach to using prescribed fire and fighting catastrophic wildfires – like the approach taken by many private and state forest managers. Consider that of the over 500,000 acres that burned in Oregon this year, over 90 percent occurred on national forests, which make up about 48 percent of Oregon's total forestland. These catastrophic fires lead to massive emissions of CO_2 – often exceeding some of our region's largest sources of CO_2 emissions.

Changes Needed to Federal Firefighting Policies.

Without a change in management strategy by our federal land managers, the risk to our federal lands will grow every single year. And this risk is not confined to the federal lands on which many of this year's catastrophic wildfires originated, but increasingly threatens adjacent private forestland, homes, and other structures.

Consider what happened to part of the 50,500 acres that our company owns in southern Oregon. In early August of this year, southern Oregon was hit with four straight days of lightning strikes. The Oregon Department of Forestry (ODF), which has lead firefighting responsibility on private land and land managed by the Bureau of Land Management, fought every lightning-caused fire quickly and effectively. ODF's focus on aggressive initial attack put out over 90 fires within less than one week. The Forest Service, on the other hand, deployed very few resources and watched most of the fires burn in the hope that the fires would yield positive ecological benefits. In dense, high-risk forests in the late summer, this type of "let it burn" approach is an unwise and often dangerous strategy based on hope rather than common sense. It also ignores the reality that our federal forests are overloaded with fuels that are ready to burst into the next catastrophic wildfire.

Looking across Oregon and elsewhere in the West, the Forest Service strategy of waiting and hoping that fires will burn themselves out is not working. When a fire is ten acres or less, a small crew and a bulldozer can often knock it down and ultimately put it out. But when fires are left to burn in risky conditions, they accumulate acres and ultimately consolidate into larger fires, so-called "Complex" fires. These fires are extremely difficult to contain in our overstocked forests, are doing little to help the ecology of the landscape, and pose huge risks to private lands and homes.

The Seattle Fire started on the Siskiyou National Forest and received no initial early attack. It ultimately grew and merged into other fires that were renamed the Miller Complex fire. This conflagration burned onto our company's property and heavily damaged approximately 60 acres of merchantable timber. ODF attempted to aid the Forest Service in protection of this private land, but received so little cooperation from the federal government that

ODF was ultimately was in no position to mount a full-scale attack to stop the fire on the adjacent federal lands

Murphy Company has serious concerns about the growing risk to our own forestland due to the combination of a lack of active management on federal lands and the consistent failure of federal agencies to aggressively attack forest fires when they are small and highly capable of being extinguished. Unfortunately, when a fire is burning the federal agencies place a relatively low priority on the risk posed to private forest lands, which is forcing companies like ours to consider taking proactive measures to limit damage to these high value assets. As you may know, federal government is immune from liability if they allow their forestland lands to remain overstocked and don't prevent the resulting fires from spreading to neighboring private forestlands. Private forestland owners can and have been held liable for the damages caused by allowing fires to start and spread to adjacent federal lands. This double standard is a serious concern to private forest landowners who border federal land.

There is a growing interest within our company and among other private landowners in determining whether the Public Necessity Doctrine gives private landowners the right to fight a fire in a national forest, including wilderness areas, where the fire presents a serious risk to nearby private forestland due to the lack of initial early attack by the federal government. Both Oregon and Washington have statutes which empower a landowner to go onto a neighbor's property to fight a fire on that property.

Suggested Solutions.

On behalf of my company and the entire forest products industry in the Pacific Northwest, I urge the Congress to take the necessary, proactive steps to restore more active management to our overstocked and diseased federal forests. This will require giving federal

agencies new legal tools to reduce the time and cost required to plan and implement forest management projects. It has been estimated that Forest Service employees spend approximately 40 percent of their time completing environmental reviews and other paperwork required by the current system of analysis paralysis. According to a recent GAO study exploring National Environmental Policy Act (NEPA) reviews of Forest Service projects, the Environmental Impact Statements prepared for some forest thinning projects take an average of nearly 5 years to complete at a cost of up to $1.2 million each. The problem is made worse by serial litigants who sue to delay and stop projects, forcing federal land managers to "bulletproof" NEPA documents and expend limited agency resources defending projects from the never-ending procedural lawsuits.

Legislative proposals such as H.R. 2936, the Resilient Federal Forests Act, would help our federal land management agencies increase the pace and scale of forest thinning and restoration, as well as promptly salvage burned timber and restore the forest with new plantings as soon as possible. H.R. 2936 would also end the nonsensical practice of "fire borrowing" where the Forest Service is forced to dip into its management accounts when it exhausts its appropriated wildfire suppression funding. We must end this practice. However, we must also remember that fire borrowing and the growing cost of wildfire suppression are high-profile symptoms of the underlying illness - overstocked and unhealthy forests. If we do not address forest management, this underlying problem will continue to worsen, forcing more and more funding fixes in the future.

Meanwhile, the "let it burn" policy being followed so often by the Forest Service is imperiling much of the West and harming the air quality for residents in a significant manner. This policy needs to be thoroughly reviewed and utilized only in exceptional circumstances

where the risk that the fire will grow is absolutely minimal and ecological benefits of allowing the fire to freely burn are abundantly certain. Congress should also ensure that state and private landowners have sufficient authority to perform initial attack suppression activities on federal lands or make federal agencies liable for damages to private lands from fires that originate on federal land – similar to the liability we face if we let wildfires burn onto federal lands.

I appreciate the opportunity to testify and welcome any questions you may have.

Mr. SHIMKUS. Thank you very much. Thank you for yielding back.

The final member on the panel is Mr. Christopher Topik, Director, Restoring America's Forest, with The Nature Conservancy.

Thank you, sir. And you are welcome for 5 minutes.

STATEMENT OF CHRISTOPHER TOPIK

Mr. TOPIK. Thank you very much, Mr. Chairman.

And, Mr. Chairman, thank you very much, and members of the committee. I would like to associate myself with all the opening statements of the committee leaders. A lot of good words were said in that messaging, as well as with my colleagues here.

I am representing The Nature Conservancy. We are a large conservation group. Our mission is to conserve lands and waters, upon which all life depends, and I would like to say also air, which is even more fundamental.

I have been involved in this issue for a long time at a policy level, and I am finding it hard not to say once again what we have been saying for years: An ounce of prevention is worth more than a pound of cure.

And we go to these hearings year after year. It is almost repetitive. I have looked at some older statements. Once again, a terrible, terrible fire year. Once again, really bad impacts from smoke. I have experienced smoke impacts myself, personally, and with elderly family members, so I know it is a real problem. And yet we still often fail to invest in the kind of preparedness that we know is important.

Air quality and the other negative impacts of these extreme wildfires can indeed be reduced if we do more forest restoration appropriately and we bring back more healthy fires. And that is part of a conundrum here, to understand that it is absolutely vital to get more fire on the landscape, but fire that we are controlling and will end up having the burns happen. And so that is the big challenge that we have.

We need to be able to adjust our thinking to long-term solutions and not just short-term solutions. And without a clear focus on forest resilience, we are going to continue to have these smoke problems.

All levels of government need to work with and support local communities to learn to live with fire and smoke. The challenge we often have with local air agencies, the only thing they can control is the prescribed fires; they can't control wildfires. And so they often have limited airshed space, and so that is what they restrict.

So this is a key area of importance that your committee can have a very major role in helping us look at long-term solutions and long-term benefits of getting the right kind of controlled burns on the landscape.

The preparation and risk reduction does work. We have seen it in many, many places. People have seen it. I know a Sisters, Oregon fire was greatly reduced when it hit some areas that had been treated, and I have seen it myself in some other extensive areas. So it is something we need to invest in upfront.

I am a forest ecologist trained in forestry and biology, but this is really a social problem. It is a people problem. And so we are

just not putting the attention we need to in working with people and communities. And a little bit of money invested in helping communities work—and I can talk for a moment about some solutions—really does work. And that is something we just need to do a lot more.

I also can't pass up the opportunity today to once again say we need to fix the emergency fire suppression funding problem. We have been saying that for years and years. It is quite embarrassing. So I am very grateful for members that are here for working on fixing the fire suppression funding so we can do the upfront investments. And that solution needs to stabilize Federal budgets for upfront work. It needs to include disaster funding for fire. Fire is the only disaster that doesn't get funding through the disaster fund. And we need to reduce harmful borrowing of non-fire funds.

With respect to the forest management reforms, I am real concerned that we be careful with taking too many shortcuts that avoid the use of science and local community involvement. I am very nervous about having very large projects approved without having local and science, and I think that that will have harmful impacts.

The NEPA process can be streamlined, but it needs to be able to be done, to actually bring people in and build trust, and be able to look at cumulative impacts of lots of activities.

Some key projects and programs The Nature Conservancy is involved in are wonderful examples, and they are really quite inexpensive, and I encourage you all to look at these: the Fire Learning Network, the Fire Adapted Communities Learning Network, the prescribed fire training networks.

Today, there are, I think, five training programs going on today, October 4, around the country, helping bring communities and first responders together to learn better how to use fire for controlled burning. And that is the kind of real collaboration we need to focus in on, bringing local communities to learn fires before, during, and after the fires, working together, and bringing the full cycle of solutions together.

I know I have been in Ashland, Oregon, a number of times, and there we are able to—we and many others are working together on a variety of solutions, all aimed at building the resilience that reduces the fire impacts.

So, with that, I want to thank you for the chance to be here.

[The prepared statement of Mr. Topik follows:]

Statement of Christopher Topik, Ph.D. The Nature Conservancy

"Using Good Science, Collaboration and Planning to reduce impacts of forest wildfires on communities and air quality"

Submitted to the U.S. House Committee on Energy and Commerce,

Subcommittee on Environment

For Hearing on Wednesday, October 4, 2017 at 10: AM in 2123 Rayburn House Office Building

The title of this hearing is, "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders"

Chairman Shimkus, Ranking Member Tonko, and Members of the Committee, and especially Full Committee Chairman Walden, thank you for the opportunity to participate in this important hearing about the impacts of wildfires on air quality. My name is Christopher Topik and for the past 6 years I have been the Director of the Nature Conservancy's *Restoring America's Forests* Program. The Nature Conservancy is an international, nonprofit conservation organization working around the world to protect ecologically important lands and waters for people and nature. We have hundreds of expert staff working all over the United States on related issues to bring science and community engagement together. Our mission is to conserve the lands and waters upon which all life depends. Prior to this job I worked as a forest ecologist at the USDA Forest Service for 16 years (10 years in support of forest management in the Oregon and Washington Cascades) and then 15 years as majority professional staff for both parties on the House Interior and Environment Appropriations subcommittee, responsible for the budgets and oversight of important natural resource and science agencies, such as the USDA Forest Service, BLM, and US Geological Survey.

The short version of my testimony is that we, at all levels of government, need to work with and support local communities to prepare for fire and to learn to live with fire (and smoke): we can reduce the harmful impacts of smoke if we increase and improve the use of safe fire. We need to alter the situation that has been so clearly displayed during this terrible wildfire season- by accepting that preparation and risk reduction works and reduces the multiple, negative of uncontrolled fires. We need to invest in upfront appropriate management, largely determined at the local level, to change our current emergency based culture of fire with a better, integrated use of good fire to reduce loss of property and harmful smoke impacts. Science and evidence based analysis of communities and landscapes is essential to guide our activities, and to do so at a much larger scale and pace. If we take too many shortcuts we can make large mistakes that can have harmful impacts on forests and communities that will last for years.

Once again I have to say that this has been a terrible wildfire season so far, fully recognizing that in many years the worst events can happen in October or even November. I know that the members of the Committee will join me in thanking the hard working and dedicated federal, state and local employees who have labored long this year to reduce impacts to communities and our environment.

There have been many costs this year- and not just the monetary costs of fire suppression, which set new federal records. I also mean costs like the long term health impacts of smoke, such as those experienced in Montana especially, which will reach far past the many weeks of dangerously bad air quality during this summer's extreme wildfires. One thing that all the Congressional Representatives should agree on is the

need for a comprehensive fire suppression funding fix. We have gone too long without regular and timely funding for emergency services for fire. And we need to get serious about investing in the up-front forest and land management, using locally based strategies, to reduce fire risk.

The tragic disasters that have struck the United States this year demonstrate that we all need to invest in preparedness and risk reduction. We have such good evidence that relatively small investments in helping communities reduce risks pay off in a big way, not just financially but also in reduced impacts to lives, health, and prosperity of our citizens. The appropriate application of science and environmental reviews is an integral part of such preparation.

Fixing fire funding is of national importance. The health and social impacts of wildfire smoke this summer were debilitating- from Portland Oregon's more than two million metro residents to Seeley Lake, Montana's less than two thousand people. The costs and negative impacts of extreme wildfires can happen anywhere and have large impacts on urban, suburban, and rural citizens. Half of Americans get their water from forests; forests are the cleansing agents that help clear our air and that sequester massive amounts of carbon emissions. All Congressional districts and States will benefit from science based fire management solutions.

National Cohesive Wildland Fire Management Strategy

There are many good things going on in America on this front. First and foremost, the National Cohesive Wildland Fire Management Strategy (https://www.fs.fed.us/restoration/cohesivestrategy.shtml) provides an action plan that

has been approved by all levels of government, from cities, counties, states, tribes and federal agencies, along with industry and NGOs. This approach requires: (1) better fire response (including use of managed fires), (2) appreciation of fire adapted landscapes; and (3) enhanced community adaptation.

It is clear from fire science and social science literature that fire is a key part of nature, and will continue to be such despite human efforts to stop it. Much of North America incudes natural ecosystems where fire plays a necessary and normal role- and as a result native species and habitats are fire adapted. As we occupy and alter more and more of the landscape, we also must learn to live with natural processes and use them to our benefit. Different ecosystems need different types of fire to remain healthy. Likewise, the human-created infrastructure in these varying types of landscapes require different strategies if they are to continue to co-exist with nature. As our climate continues to warm in the coming decades, scientists anticipate even more extreme weather and fire events will become the new normal.

Smoke management is indeed an important component of fire management. I have had personal experiences with wildfires and I have seen the impacts on my elderly family members suffering during wildfire events in California. Recent science on western U.S. wildfire smoke emissions and forest management indicates that controlled burning is the most efficient and effective way of reducing overall smoke impacts on air quality in fire prone landscapes. A comprehensive, recent paper (Liu, et. al; J Geophysical Research Atmospheres, Vol 122, issue 11, June 16, 2017 "Airborne measurements of western U.S. wildfire emissions: Comparison with prescribed burning and air quality implications") indicates that smoke from controlled burns has only 1/10

the negative impacts of smoke from uncontrolled wildfires. Much of our American forest and shrublands are ecologically primed to burn at some time, so to really reduce smoke impacts on air quality, we need to invest in more deliberate use of controlled burns.

In areas where the cultural use of fire has not been lost, or where it has been reestablished, we have a much greater chance to minimize destructive megafires. These areas include some southern forests dominated by longleaf pine and increasingly, areas of shortleaf pine in places like Arkansas. Other pyrogenic landscapes, such as the chaparral or shrub of extensive areas in California and surrounding states, will most certainly burn at some time- and they can burn explosively. Defensible space, sufficient ingress/egress routes, and controlled burning in the cooler and wetter months are essential to protect people and property.

There are also millions of acres of dry forests, especially in the western states dominated by pines, where our previous over-zealous fire suppression policy led to extensive areas of dense unhealthy forests that burn explosively. Many of these areas would benefit from strategic fuels treatment, followed by controlled burning, to return them to the frequent, low intensity fire regimes that dominated this part of the continent for thousands of years. The Forest Service estimates that there are about 11 million acres in the National Forest System that are not in reserved areas or municipal watersheds that would benefit from strategic fuels treatment and controlled burns. I encourage those here today to focus on these areas that are known priorities with well accepted scientific treatments, rather than pursue more general demands to increase timber harvests.

Almost everyone agrees that healthier fire on the landscape- from grasslands to shrublands to forests- would be beneficial. There have been substantial increases in the amount of good fire on the landscape in recent years, yet we are having a hard time making the dramatic increases in acres treated that are necessary to effect real change. The scale and pattern of current treatments is not even close to being commensurate with the need for restoration and maintenance. Besides the clear need for more controlled burns on all ownerships of fire-prone lands, we also need to be more aggressive about using wildfire events, where safe, to increase acres treated. Fire use is not without risks, but if leaders clearly articulate the benefits, we could implement much healthier and lower impact burning. I am encouraged by the desire of the Wildland Fire Leadership Council to take on the issue of smoke management so that we can better understand the trade-offs between smoke during controlled conditions versus the devastating air quality suffered during catastrophic and enduring fire events. Communities will fare better when they can play a role in deciding when, where, and in what duration smoke affects them. Controlled burning provides this opportunity.

Proven Solutions: Fire Learning Network and Fire Adapted Communities Learning Network

I encourage the Committee to look at examples of successful programs that are helping people learn how to live with fire and smoke while strengthening local partnerships and increasing capacity for cross-boundary restoration and fuel reduction. The Fire Learning Network (http://www.conservationgateway.org/fln), a cooperative program of the US Forest Service, Department of the Interior agencies—Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service and National

Park Service—and The Nature Conservancy, has a 15-year proven track record of helping restore our nation's forests and grasslands and making communities safer from fire. Since its start in 2002, the FLN has supported 162 landscapes in 40 states and worked with more than 1,440 partner groups. Through collaboration, the Fire Learning Network helps build trust and understanding among stakeholders, access training and capacity building that helps fire professionals work with local communities, and builds public support for forest and fire restoration- all while also benefitting from being in a national network that increases knowledge sharing and generating new ways of doing business.

Recent examples of the Fire Learning Network's success relevant to controlled burning and smoke management include:

- In both central Oregon and Ashland, FLN partners are seeing the importance and the power of having a multi-faceted strategy about smoke outreach. The partners are reaching an ever-growing and diverse audience of locals and visitors who care deeply about the region's forests. Key communications, delivered through social media, TV, radio, newspapers and at movie theaters during the spring controlled burn season, helped increase support more broadly for tolerating associated smoke when paired with proactive protection and mitigation strategies for smoke-sensitive populations and individuals.
- In California, our work with a diverse partnership of National Forest, Tribes, communities and CALFIRE through the Western Klamath Mountains and California Klamath-Siskiyou FLNs has led to community engagement in planning, training, and implementation, which resulted in significant improvements of fuels treatment, forest restoration, and community wellbeing.

These efforts, along with the initiation and expansion of Prescribed Fire Councils in the west, started with important discussions about smoke in WA, CA, and OR and have also been key in influencing the Western Regional Cohesive Strategy Team to expand their leadership to further enable important collective impact towards the goals of the Cohesive Strategy.

- And specifically, today (October 4), there are five Prescribed Fire Training Exchanges (TREX) currently taking place in New Mexico, California, and Washington, where professional fire workers from across the country (and even internationally) are building local fire management capacity while completing controlled burns and other fuel reduction treatments that help communities and ecosystems. Participants get hands-on experience in ecological burning, receive training in communicating with the media, develop their fireline qualifications, and learn about local ecology and conservation issues, all in a setting that emphasizes safety, learning and cooperation.

The most cost effective and under-valued solution to harmful fire is through structured engagement of communities at risk. It is essential to develop local skills and local visions for how communities should take action to protect themselves and their surrounding wildlands. Different places will have different needs and differing cultures will, and should, generate different solutions. As a nation we don't hesitate to respond in massive fashion during immediate emergencies, but we are not so good at funding the preparedness that we all know has a great return on investment. It is encouraging that the US Fire Administration is taking a more holistic view of fire preparedness and hazard mitigation; other governmental bodies and industries should do the same.

Another example of a cost effective program is the Fire Adapted Communities Learning Network (http://fireadaptednetwork.org). Launched in 2013, and rooted in the lessons of the FLN, FAC Net now engages well over 100 community leaders in 28 states, ranging from small communities in the wildland matrix to huge cities like Austin, Texas. The purpose of these networks is to significantly accelerate the spread and adoption of concepts and actions that will help communities help themselves become better adapted to fire.

The values of the Fire Adapted Communities Learning Network are:

- Adaptation is critical to a positive future.
- Collaboration and partnerships are keys to successful adaptation.
- Investment in local-level capacity, partnerships and responsibility yields the best outcomes.
- Supporting the coordinating function within communities is essential to leveraging the range of resources, institutions and individuals necessary to build fire adapted communities.
- Investing in learning across communities and geographies is a strategy that works at multiple scales, including:
- Facilitating the adoption of best practices and innovations;
- Building a community-of-practice to fuel inspiration and innovation;
- Aggregating lessons learned to advise the design of programs and policies in support of fire adapted communities; and
- Leveraging lessons learned to inform policy and resource allocation, as appropriate.

Proven Solutions for Federal Forests: Collaborative Forest Landscape Restoration and Joint Chiefs' Landscape Restoration Partnership

Nearly half of America's forests are publicly owned, highlighting the need for collaborative active management. The Collaborative Forest Landscape Restoration Program of the USDA Forest Service (CFLR) demonstrates that collaboratively-developed forest restoration plans can be implemented at a large scale with benefits for people and the forest. This is a model approach that brings citizens, local government and federal staff together to determine effective management that is locally appropriate and provides jobs, sustains rural economies, reduces the risk of damaging fires, addresses invasive species, improves wildlife habitat, and decommissions unused, eroding roads. This program should have its authority extended to 2024, and funding increased to at least $60 million per year. A funding increase will guarantee the existing 23 successful projects can continue, and additional critical projects across America can begin.

The Joint Chiefs' Landscape Restoration Partnership of the Natural Resources Conservation Service (NRCS) and the Forest Service provides targeted funds that help local communities and land owners, including cities and counties, to do cross-boundary work to improve conditions on both public and private lands together. It is a great example of USDA Secretary Perdue's call for shared stewardship of our nation's forests. So far more than 50 individual projects are completed or under way to improve forest and rangeland ecosystems so they are healthy and resilient. Such healthy lands produce better water and less harmful smoke when experiencing wildfires.

Federal Policy needs:

The Congress can make a real difference at reducing wildfire smoke impacts by supporting policies that maintain healthy and resilient forests. We need to increase the long-term protection of forest resources from threats such as catastrophic wildfire, insects, and diseases- and promoting the use of fire as an important forest management tool will help us achieve the goal of maintaining healthy and resilient forests. We cannot just log our way out of the fire problem. Appropriate timber harvest, when coupled with fire that emulates natural processes, is one of the tools needed, but we need to implement the entire forest restoration package. This will vary tremendously depending on the natural and cultural environment.

State and Private Forests:

1. Create incentives for increasing prescribed burning and other forest management on state and private forests and grasslands by formally addressing the challenges to using this tool. Use the Farm Bill and other legislation to prioritize projects that use prescribed burning and other forest management activities through Conservation Title programs.

2. Provide adequate Federal resources to encourage states, tribes, and counties to implement the Cohesive Strategy.

3. Find new funding mechanisms, such as Forest and Water Funds, that support enhanced forest restoration projects. These projects can reduce the impacts of harmful, extreme wildfires through the use of established funding sources that would be leveraged with non-federal funding sources.

Public, including National Forests:

1. Invest in reducing wildfire risk by restoring healthy forests.
2. Create an Accelerated Landscape Scale Restoration authority
3. Extend the Collaborative Forest Landscape Restoration Program to 2024,
4. Improve existing U.S. Forest Service authorities: 1) Good Neighbor Authority, by allowing road access; and 2) Stewardship Contracting,
5. Any fire suppression funding solution must be comprehensive by including the following three criteria: 1) address the continued erosion of agency budgets that results from the increasing ten-year fire spending average, and stabilize the level of funding for suppression within the agencies; 2) access disaster funding for extraordinarily costly fires, including those that may be calculated as part of the ten-year average; and 3) significantly reduce the need to transfer from non-suppression accounts and programs.

Conclusion

In a recent (September 15, 2017) *Washington Post* perspective, Sarah Coefield, air quality specialist with the Missoula City-County Health Department, helps us frame this discussion by her statement: "We live in a fire-adapted ecosystem, and, out of necessity, we're becoming a smoke-adapted community. The valley rain and mountain snow are coming. We will stop and breathe the clean air. And then we will get ready for next year."

It is time for concerted action by the Congress and others. I thank the Committee for the opportunity to appear today to discuss the need to improve our investments and

procedures regarding wildfires and their impacts on air quality. The Nature Conservancy is ready to join with you around the nation to push for and implement solutions at both the federal and local levels.

One-page Summary for 10.4.17 hearing of House Energy & Commerce Committee

Air quality and other negative impacts of extreme wildfires can be reduced if we increase forest restoration and bring back healthy fires that reduce the risk of dangerous fires that produce massive smoke emissions.

All levels of government, need to work with and support local communities to prepare for fire and to learn to live with fire (and smoke): we can reduce the harmful impacts of smoke if we increase and improve the use of safe fire.

We need to alter the situation that has been so clearly displayed during this terrible wildfire season- by accepting that preparation and risk reduction works and reduces the multiple, negative of uncontrolled fires.

We need to invest in up-front appropriate management, largely determined at the local level, to change our current emergency based culture of fire with a better, integrated use of good fire to reduce loss of property and harmful smoke impacts.

We need to fix the broken federal emergency fire suppression funding situation.

Science and evidence based analysis of communities and landscapes is essential to guide our activities, and to do so at a much larger scale and pace. If we take too many shortcuts we can make large mistakes that can have harmful impacts on forests and communities that will last for years.

Proven programs exist that need to be emulated and expanded. Prime examples are the Fire Learning Network and the Fire Adapted Communities Learning Network. Other key, though much too small, programs include the Joint Chiefs' Landscape Restoration Partnership (NRCS plus Forest Service) and the Collaborative Forest Landscape Restoration program at the Forest Service.

Mr. SHIMKUS. The gentleman yields back his time. We thank you for your testimony.

Now we will go to the questions. I will start first, and I will recognize myself for 5 minutes.

So this subcommittee is the Environment subcommittee, and a lot of our focus is going to be on air quality and issues. So the forestry debate, for some of those who live in the West, they know it, but this is like "Forestry 101 for Dummies" for us, so I have a couple quick questions.

Mr. Bailey, you said "fuels." So define "fuels" for those of us who are not from forest areas.

Mr. BAILEY. Sure. Do I have a 45-minute lecture here? No. All right.

So we would first divide living fuels versus dead fuels. But, of course, the heat of the fire converts a living fuel into a dead fuel. But living fuel would be all the things that you would visualize when you walk through the woods out there. The dead fuels include those aerial fuels up above the ground surface——

Mr. SHIMKUS. So it is not just dead trees.

Mr. BAILEY. Not just dead fuels—it is a whole——

Mr. SHIMKUS. Is the dead trees the predominant fuel that we are talking about in this debate?

Mr. BAILEY. No. The dominant fuel that is driving fire-spread on an individual hillside or across an entire landscape are the fine surface fuels, some living, some dead, because they are so reactive to the fire flaming front as it comes through.

Mr. SHIMKUS. OK.

Mr. Karels, you used the terminology "hazardous fuels" in your statement. So what is a hazardous fuel? Or is it the same thing?

Mr. KARELS. I think it is the same thing. It tends to become a hazard when it gets too heavy, when the fuels build up to where there are ladder fuels, ground—the surface fuels the doc talked about that has a ladder all the way to the tops of the trees. So you haven't thinned it; that forest is not open. There is not a prescribed fire program that is reducing the ground-floor fuels. Now you have a ladder to the top. Now you have pictures like the one you showed on the Columbia Gorge where the fire is going 150 feet high.

Mr. SHIMKUS. So is the ladder to the top dead trees?

Mr. KARELS. Not just dead trees. When you have a drought, those live trees, fuel moistures go very low. The conditions underneath preheat, and it takes the live trees just like it takes the dead trees.

So you have a combination of both. You have a combination of hazardous fuels that are dead trees and all—really, what we call all that ladder fuel in between. If you have a scattered, thin forest, you don't have those ladder fuels going to the top, and you tend to have a lower surface fire that is easier to suppress than the heavy fuels, the hazardous fuels that take it into the crown and run with it, run 14 miles in a single day.

Mr. SHIMKUS. Let me ask a question. With the hurricanes that just went through Florida, was there a lot of toppling of trees so that there is a buildup of fuels in the State of Florida now?

Mr. KARELS. In the southwest portion of the state, there was. It will significantly increase the hazardous fuels through that lower portion of Florida, from about Orlando, Tampa, down.

Mr. SHIMKUS. Is the State of Florida trying to manage that excess fuel?

Mr. KARELS. We are beginning that process. Really, right now, Chairman, we are just digging out. I am surprised I am here today, because I had 500 people in response right up to last week. But that is our next step, to start to deal with those fuels.

Mr. SHIMKUS. And let me go to Mr. Marshall.

Did you say something about break fuels? Or——

Mr. MARSHALL. My specialty is fuel reduction, removing the fuel so there is lower risk of fire. What you will see in the West a lot of times is, fire doesn't acknowledge property lines or section lines, so where you have these checkerboard ownerships, we have implemented on our own forestlands, a thinning regime so that we actually reduce the fuel load, so when the fires come off the Federal lands, there is a chance to stop them because of our significant investments in these lands.

Mr. SHIMKUS. And so let me go to the question I was supposed to ask from committee staff, and that is to Mr. Karels.

One study indicates that wildfires burning within 500 miles of a city routinely caused air pollution to be 5 to 15 times worse than normal and 2 to 3 times worse than the worst non-fire day of the year. How does that track with your experience?

Mr. KARELS. It tracks fairly well, Chairman, and, again, it depends on the winds. It depends on the conditions and where and stuff. But those are what we tend to call large, catastrophic fires, they put a tremendous amount of smoke, a tremendous amount of particle matter. And it is not uncommon for impacts 200, 300, 400 miles way.

I will give you an example. We impacted the city of Chicago in 2007 from one of the swamp fires on the Georgia-Florida line. And just depending on how the winds are, it is that much of an impact with those heavy fuel loadings and those really large fires.

Mr. SHIMKUS. Great. Thank you for your answers.

Now I turn to the ranking member, Mr. Tonko from New York, for 5 minutes.

Mr. TONKO. Thank you, Mr. Chair.

And, gentlemen, again, welcome.

As you heard during opening statements, all the evidence points to a trend in recent years of more numerous and more severe fires. My supposition is that this is due to a number of factors, some of which involve forest management, but many are associated with the effects of climate change.

According to a 2015 United States Forest Service report, "The United States burns twice as many acres as three decades ago, and Forest Service scientists believe the acreage burned may double again by midcentury."

A 2012 Climate Central report found that burn season is 2 1A½ months longer than it was 40 years ago and that, for every 1-degree Celsius temperature increase the Earth experiences, the area burned in the Western United States could quadruple.

So, Dr. Bailey, do you agree with this assessment?

Mr. BAILEY. Yes. I have read those reports and others. It is consistent.

Mr. TONKO. So what are the specific driving factors for the longer fire season in recent years? And do you believe these factors are strongly associated with climate change?

Mr. BAILEY. From my reading, yes. Based on the warming, the reduced snow pack, the small change in seasonality of precipitation.

And some of it is our definition of the fire season. It is not a hard-and-fast thing. It relates to the deployment of resources and that kind of thing, as well.

But I don't think there is any question that it is. The fuels dry out sooner. We have to get our resources out there sooner. And they are out there later in the fall. So that is what translates to the longer fire seasons.

Mr. TONKO. Thank you.

And, Dr. Topik, what is your view of that assessment?

Mr. TOPIK. Well, I certainly agree with that assessment. I would also point out, the challenge here is not just the number of acres but the type of acres. And so——

Mr. TONKO. Meaning what?

Mr. TOPIK. What I would like to see us have is lots of acres burn in a very low-intensity fashion, producing low emissions, low harmful smoke, rather than these big, bad, nasty fires. And so I also agree with my colleagues that we do need to do a lot more active management, but that has to be followed up with controlled burns to actually bring back the kind of resilience that, in a long term, will work.

And, certainly, the climate change connection is real, and it is part of the problem of the vacillation of extremes. And so it just points to the need, I think, the opening statement remarking how important forests are for sequestering carbon. I mean, they are now sequestering, what, 13, 14 percent of the Nation's fossil fuel emissions. And so this is an area where we can intervene for all these benefits that our panel has discussed.

Mr. TONKO. Thank you.

And I believe that it is clear that any long-term preventative plan for wildfires and the dangerous air pollution they produce needs to get to the root of the problem and get serious about addressing climate change as a national priority.

The 2014 National Climate Assessment found that, as temperatures increase to levels projected for the midcentury and beyond, Eastern forests may be at risk of die-off. Many Americans, including Members of Congress, typically see wildfires as a Western issue.

So do any witnesses, particularly Mr. Karels, want to comment on whether there will be an increasing wildfire risk to the Eastern United States?

Mr. KARELS. Again, that is hard to say. Go back to Mr. Topik's discussion, is the type of fuels. When our fuels get heavier, when we don't manage the forest, when we don't prescribe burn, the numbers are going to go up and the impacts are going to go up.

When you can prescribe burn, significant number of acres to make a difference, you have the opportunities to have these low-

intensity fires that are, one, easier to suppress, or we can manage without the smoke impacts, without the timber losses, and still have fuel reduction efforts.

So I look at it as more of how we manage our forest. If we keep our forest healthy, we can keep the numbers and, really, the real impact to our citizens down.

Mr. TONKO. And are there any different forest management techniques or strategies to regulate or manage these fires in the East?

Mr. KARELS. In the East, especially the Southeast, prescribed fire is a significant tool. Florida burns 2.3 million acres a year with prescribed fire. Every year, among 20 million people, we burn that many acres each year. With the fuel growth in that subtropical environment, you would say, that is what keeps us from having absolutely catastrophic fire every year down there.

And much of the Southeast does a very good job in that prescribed fire. It has been part of a culture, and the laws and stuff allow it. That is low-impact. You do have some smoke; you do have to manage it. But that is what our business does, is prevent impact to the citizens.

So there are tools like that, and there is active forest management in the East, very much so. The Southeast is the wood basket of the world. And that active management helps reduce the fuels and those hazardous fuels I talked about earlier.

Mr. TONKO. Thank you, Mr. Karels.

Mr. Chair, I yield back.

Mr. SHIMKUS. The gentleman yields back his time.

The chair now recognizes the chairman of the full committee, Mr. Walden, for 5 minutes.

Mr. WALDEN. I thank the gentleman.

And I think we have a couple other slides.

I actually took this out of an airplane, flying back here. That is Mount Hood that rises 11,238 feet. So the fire picture you saw from Mr. Schrader was the face of this fire. This is up on top, then, a day or so later, looking out. You can see how that smoke just covers everything. That was all burning. They had 10 helicopters trying to put out that fire, and it was so smoky they often couldn't fly the helicopters.

Go to the next one.

This gives you a shot from the Washington side of the Columbia River. That is, I don't know, probably a half-mile, mile across river as it burns, and this is looking the other direction. But it just tells you this went on for weeks. And this is just one example of multiple fires.

And I want to follow up with Dr. Topik.

On your point about fire funding, we are all in. In fact, I was in a meeting in the Speaker's office with a number of the Westerners last night again, and he is being very helpful and supportive. I have great confidence that this administration is going to replace the funds, over $600 million, hopefully in this next tranche, so that we can get the money back into the account for the Forest Service.

But you are spot-on. Every year, we repeat this stupid, stupid cycle of robbing the accounts that would do the forest thinning to pay for the firefighting while the fires are going on. So we don't do the preventive work because you have to pay for the fire. Then we

replace the money when it is too late to do the preventive work because winter has set in. And then we repeat it. It makes no sense. It is four to five times more expensive to fight fire than to do the treatment.

And while prescribed fire is very important and a subject of our hearing—and I know the CDC and the EPA are looking at studies on the effects of prescribed fire smoke versus wildfire smoke, and I think we are going see it is dramatically different because you can manage it. We can do even better than that by thinning out the forests and getting them back in balance.

So we are trying to solve the fire borrowing issue. We are trying to solve the fire funding replacement issue. And, again, I think the Trump administration is fully on board to do that. But we need the management tools to be expanded in the proper way.

You mentioned the Ashland Watershed Project. That is, I think, being done under the Healthy Forests Restoration Act, which I helped write, I don't know, a number of years ago. And I have been up on that project. It is expensive to do, but it is incredibly important to do to save that watershed above Ashland.

But I want to go to our forestry professor from Oregon State University, because I would like you to answer about stand densities. We have talked about the fuel loads. But some of these stands on a given acre on the east side of Oregon should have how many trees in a dry forest environment versus what they have today?

Mr. BAILEY. It would cover a spectrum. The driest end, the ponderosa pine with a little juniper underneath, might be as low as 20 trees per acre, so truly a savannah or a woodland instead of a forest.

Mr. WALDEN. And on those sorts of forests today that have been left untreated and unburned, how dense is that?

Mr. BAILEY. Some of them that I have gone into are a thousand stems per acre.

Mr. WALDEN. A thousand trees per acre where it should be 20. This is the fuel loading. And every year some of those die, the growth continues. It is like just adding more gas into another can. And you just wait.

We get dry lightning in the West. Here, you get these thunderstorms and it rains and washes everything. We just don't get the rain. It shuts off. We went, I don't know, 88, 90 days with no rain this summer. It is not abnormal, a little abnormal. And temperatures are rising, the climate is changing, I get all that. But we have this building fuel load that we need to deal with.

And on the west side, in terms of overstocking, what forest?

Mr. BAILEY. Well, similarly, there is less of a frequent fire history on the west side. The Douglas fir forest, including down into your part of the country, probably we had surface fire in there maybe every 40 to 70 years or so, historically. But those stands also are more dense because we have been excluding fire longer than that.

Mr. WALDEN. Yes.

I want to quickly, in the remaining few seconds I have—Mr. Marshall, thanks for being here, first of all. From your perspective, there was a lot of discussion about how fires are fought on Federal land, within certain designations on Federal lands, versus state

lands, county lands, tribal lands, and private lands. What did you see this summer? What should we know?

Mr. MARSHALL. There is a little bit of a perception, I believe, that we need to understand fire and understand its healthy impacts, but my perception is we are seeing that that really has a window, just like we are seeing the window of these fires blowing up and being, in my opinion, truly catastrophic.

So I heard a lot about healthy fire, healthy fire from the agencies where, on the lands that you referenced that are Federal, we are seeing initial attack, stop the fires, mitigate the risk.

Mr. WALDEN. You are also doing active management then.

Mr. MARSHALL. And we are actively managing, so we see ground fire, so my perception is that there is a little bit of an understanding that we need fire, but it isn't understood when that time is, and so the Federal agencies are backing off a little more regularly than we see the other agencies, and the fires are getting bigger, faster, and more severe.

Mr. WALDEN. Thank you.

Mr. SHIMKUS. The chairman's time is expired. The chair now recognizes the gentleman from California, Mr. Peters, for 5 minutes.

Mr. PETERS. Thank you. I want to just start by thanking Chairman Walden for his comments about wildfire funding. In the 113th and 114th Congresses, I supported the Wildfire Disaster Funding Act and even led a discharge petition to bring the bill up on the floor, because we don't want to be spending prevention money on fighting fires, and we do that, as I understand it, because of a fealty to this year-by-year scoring, and it is the silliest thing to say we are going to save money this year, but we know that it is going to cost us more next year. We ought to just understand, make a decision like a business or a family would here, and spend money on prevention to save money later. And so, I would say to the chairman I would love to work with you on that. There are a lot of nonsensical things that we come across here, but I think that is just idiotic.

I know that the Nature Conservancy has done some work on a carbon offset program, and that is a California kind of thing. We have a cap and trade system there that is not the Federal Government's approach, and I understand that in California, that the trading of offsets has been able to reduce emissions, but I would like to ask maybe Dr. Bailey and Dr. Topik in particular, can you tell me what Federal policy is missing? If you could change three things, what would you change? I will start with Dr. Bailey.

Mr. BAILEY. So could you ask the question again?

Mr. PETERS. What is Federal policy missing? So I hear a lot of violent agreement about the need to deal with forest fires. Where are we falling short? What would you like to see us change? You are talking to the decisionmakers in the Federal Government, what would you like to see done differently? Or more or less?

Mr. BAILEY. Yes, so the forest service, sometimes we are guilty of criticizing the forest service for not doing this or doing this. But they are a great group of individuals, and they are doing as best they can with the laws, the rules, the administrative rules and policies and case law that drives them to this situation where they have a hard time doing their job as foresters in my opinion.

So we are probably overdue for an overhaul that updates the sets of rules that they operate under, now that we have a better understanding of the role of wildfire.

Mr. PETERS. So the rules that govern the forest service are too restrictive in terms of allowing them the freedom that they need to do their jobs.

Mr. BAILEY. To do their jobs.

Mr. PETERS. Dr. Topik?

Mr. TOPIK. I am going to cheat a little bit here, but the first thing is really getting serious and implementing and funding the National Cohesive Strategy for Wildland Fire Management. There we have a well-thought-out plan that has been agreed to by the League of Cities, by the National Association of Counties, by the states, by the tribal organizations and all the Feds, and it calls for some really important action. And so the strategy can make a big difference. So that is one thing.

Secondly, I mentioned before the fire suppression funding fix. I would love to see that in the next disaster relief bill. And then, I think, the third thing is the social engagement, the small amounts of money to fund people to help bring communities together so that they can learn and bring science together with collaboration at a local level.

Mr. PETERS. When a community comes up against science and doesn't agree with the science, what do you do then?

Mr. TOPIK. It is pretty amazing. What I have seen in practice, for instance, in Bend, Oregon, in the Nature Conservancy, we have a guy who is just so good at doing GIS, geographic information systems, so in real time, you can sit down and have the scientist with people do what-if scenarios. And so that is not free. It takes time. So I think that is the kind of thing we need to invest in, so that the science is directly understandable and displayed to people.

Mr. PETERS. Do you disagree with Dr. Bailey's assessment that the forest service's hands are tied by political constraints?

Mr. TOPIK. Well, I would like to see them do a lot more, and I know they want to do more, and I think, once again, if you look at the real buying power, I was one of the, I hate to admit it, so long ago, I was one of the authors of the National Fire Plan back in 2001 and we did an initial rapid increase in funding for the engagement, including hazardous fuel reduction and community engagement and restoration. And then it just waned. And the real buying power has dropped dramatically, and so that is a big problem. When you have Federal agency staff you have merged countless numbers of ranger districts where I used to work anyway.

Mr. PETERS. OK. Thank you, Mr. Chairman. My time is expired.

Mr. WALDEN. The gentleman's time is expired. The chair now recognizes the gentleman from Mississippi, Mr. Harper, for 5 minutes.

Mr. HARPER. Thank you, Mr. Chairman, and thanks to each of you for being here, and certainly what difficult times we have had in certain places in our country, particularly in Oregon, and you look back and certainly we can come up with the causes and reasons why this was worse. But would it be safe to say that each of you agree that if we actively manage forests, that that significantly

reduces the risk and severity of wildfires. Does everybody agree with that?

Mr. BAILEY. Yes.

Mr. TOPIK. Yes.

Mr. MARSHALL. Yes.

Mr. HARPER. OK. Obviously how we go forward is going to be most important, because there are other spots just waiting for another tragic wildfire that impacts a community. So what I want to ask each of you, and if you can just briefly, if you could say what would be maybe the top regulatory or legal impediment to forest management? Is there something that just, Hey, this is it, this is the top thing, and we could start with you, Mr. Bailey.

Mr. BAILEY. In my experience in working with the collaborative groups, that is where the action is going to be in the future, is the NEPA process itself is applied at such a small scale, individual projects of just a couple acres, it still needs to go through this involved NEPA process that I think is well beyond when that law was written and what NEPA was intended for, and we tend to just over apply it for relatively small, meaningless activities.

Mr. HARPER. So, Dr. Bailey, if we were able to speed up that timeline and not make it on every small thing, that is going to have a positive impact?

Mr. BAILEY. The process and the timeline it is very important it is going to be hard to speed it up, but we don't need to apply it on a 20-acre thinning. We can apply it on a 50,000-acre landscape management plan.

Mr. HARPER. All right. Thank you. Mr. Karels?

Mr. KARELS. I think I am pretty close with Dr. Bailey. Allowing those larger landscape scale projects, that categorical exclusions allow them to implement some of these practices that reduce the fire threat. An example with putting a state agency in a state forest and a national forest beside each other, and we can implement the same project in one month on a state forest, which may take 3 to 5 years on a national forest. And it is not because they don't want to do it; it is because, as has been said, their hands are tied of going through that very intensive process, and then sometimes the legal battles that come out of it.

Mr. HARPER. And so those impediments, as you are saying, differ between Federal, state, and privately owned lands. So that creates different time frames is what you are saying. Would that be correct, Mr. Karels?

Mr. KARELS. Correct, yes.

Mr. HARPER. OK. And, Mr. Marshal, tell us what we can do?

Mr. MARSHALL. I agree completely with my two colleagues. We have a problem with the planning and the NEPA process. We see successful instances throughout the west where this moves quickly, and we get good products where we have, for lack of a better term, a social license within the community, because the community is well-educated to Dr. Topik's point. What doesn't still insulate us from the success of those projects is somebody coming in and sticking a cog in the spokes of the wheel and stopping the whole project. So we still see great projects moving forward. Things are getting done. But then we move to another region where there is a nega-

tive view of restoration efforts, and it can just stop with a lone legal challenge.

Mr. HARPER. And having unmanaged, how should we say, surface fuel is going to be a problem to deal with if we don't solve it. Dr. Topik, I would to hear your view.

Mr. TOPIK. Just to change the theme a little bit, we do need to invest some money in this activity in getting people together and getting the communities together. So I think we have to be serious, also, about providing funds so local communities can work together and get projects done at big scale, like the others have said.

Mr. HARPER. Thank you all for being here. My time is almost expired. I yield back. Thank you, Mr. Chairman.

Mr. WALDEN. The gentleman yields back his time. The chair now recognizes the gentlelady from California, Ms. Matsui, for 5 minutes.

Ms. MATSUI. Thank you, Mr. Chairman, and thank all of the witnesses for being here today. Already this year we have seen many natural disasters hit communities across the United States: hurricanes, flooding, tornados, and hail, have taken lives and destroyed property. Unfortunately, we can add devastating wildfires to this list. These wildfires have burned more than 8 million acres of land, have serious consequences. They degrade drinking water quality, destroy wildlife habitat, and limit outdoor recreation. And as we have learned from our witnesses, they impact our air quality.

I have repeatedly highlighted for this committee how the Sacramento region in California, in my district, struggles with air quality, and in the summer, wildfire smell contributes to our air quality challenges. I call them "challenges" because we view poor air quality as a problem that can be solved. I am pleased that our witnesses share that view that there are proactive and environmentally friendly steps we can take to reduce fire risk and improve air quality.

Dr. Topik, in 2014, the King Fire burnt over 97,000 acres in the American River Watershed near Sacramento. The fire caused particulate matter pollution to reach unhealthy and hazardous levels over the large region in Northern California. I understand The Nature Conservancy has partnered with environmental groups, local agencies, and the forest service to speed watershed restoration in the American River Watershed under the French Meadows Forest Resilience Project.

Dr. Topik, how does this project and other Nature Conservancy collaborations help us better manage our Federal lands to approve the health of our forests and protect our air quality?

Mr. TOPIK. Thank you. I am not an expert in that specific project, but I have been nearby to other places. I think the key there, as in many places, is getting people together to have a joint vision, and actually implementing it. And so in French Meadows and nearby—elsewhere are studies in the Mokelumne River, which provides the water for East Bay. We have done analysis that shows getting in and helping treat these areas pays, just like the full committee chairman has said, it pays. So I think that is a key.

Last week, as part of the forest climate working group, I heard some fascinating work in California regarding forestry and the use of carbon offsets that Mr. Peters had talked about. And so there,

I think, State of California alone is committing $200 million for all kinds of forest-resilient treatments, and I think getting that kind of cooperative work is vital.

I wanted to—I didn't mention in my statement, but a really good comprehensive research summary paper by Scott Stephens, Brandon Collins, Eric Biber, and Peter Fule has a very good discussion of air quality in the San Joaquin Valley, and I encourage you to take a look at that.

Ms. MATSUI. Thank you. Dr. Bailey, as you say in your testimony, you have had a tough fire season throughout the west, including in California. In California, we have already had 230,000 acres impacted by wildfires. This is 30,000 acres above the 5-year average, despite the fact that we have had one of the wettest winters on record.

Dr. Bailey, how much of impact does winter precipitation have on the strengths of summer fires and the length of the fire season?

Mr. BAILEY. Yes, it is a little counterintuitive. And actually, when I talk to students, I usually explain the great old adage that if it is a dry winter and a dry spring, all of us firefighters are going, oh, yes, it is going to be a good fire year because it is dry and the fire season starts early. And if it is a wet winter and a wet spring we go, oh, it is going to be good fire year because it grows all of those fuels, and particularly those fine fuels, they become more abundant and more continuous than they typically are. And so when it does inevitably dry out, as it does in Oregon and California, and they inevitably catch on fire, it burns very continuously. So either way, and that is part of the lesson of the wildfire being inevitable. Either way, we get a fire season.

Ms. MATSUI. So a wet season we are going to have fire.

Mr. BAILEY. Always have, 10-, 15,000 years.

Ms. MATSUI. All right. Sacramento County has a large population of approximately one and a half million people located near many Federal and state lands.

Dr. Topik, have you seen any unique challenges with addressing wildfires are in close proximity to large urban centers?

Mr. TOPIK. It is really hard to convince people that suffering from smoke from controlled burns is worth it, and so I understand that and realize that and have seen it, but that is why we need to get better tools and get people together to actually see that they can have benefits. And I referenced, in my statement, a comprehensive science review paper on air quality and smoke, and they are saying that controlled burns are going to produce perhaps as little as one-tenth the amount of smoke as wildfires. And so convincing people and bringing people into that conversation is absolutely essential.

Years ago, I was in Florida where they have to do controlled burns constantly for longleaf pine every 4 years, and the people with their rows of $1-million houses with swimming pools next to the state park, they were just told ahead of time when they were going to do a burn, and everybody covered their pool up, but that didn't happen overnight. It took a lot of people.

Ms. MATSUI. Education is necessary. Thank you very much, and I yield back.

Mr. WALDEN. The gentlelady's time is expired. The chair now recognizes the gentleman from Texas, Mr. Olson, for 5 minutes.

Mr. OLSON. I thank the chair, and welcome to our four witnesses. This is a very important hearing for me. My wife spent a lot of time as a young girl in Sun Valley in Ketchum, Idaho. She loved it so much, last Thanksgiving we bought a small condominium in Ketchum, a fire zone in Idaho. We have spent the last half year calling our landlord every 2 weeks to make sure our condo is not threatened by fire.

My home State of Texas doesn't have much public land, so we don't have the problems of mismanagement by the Federal Government. We can have some big fires. The fire on the screen was historic Bastrop County, Texas, September through October of 2011. This image is from our state capital, Austin, Texas. It is 33 miles east of Bastrop. The Gulf Coast surface winds tend to blow from the southeast so that smoke blew over Austin, Texas and probably San Antonio. Higher up, the jet stream takes that smoke to the east. It came over my home town of Sugar Land, Houston, Texas and probably Dallas and Fort Worth, as well.

Also, right there by Bastrop is a very special part of Texas. It is unique. It is called the Lost Pines. Those pine trees are 150 miles, many of the pine trees in Texas. Somehow they settled around Bastrop. They were threatened by that fire. That fire put most of my state out of compliance with the Clean Air Act. My state asked for an exceptional events exception. They were denied by the previous administration multiple times. Look at that photo. Is that massive wall of fire and smoke unexceptional? No. That is very exceptional. That is rare.

So my question, Mr. Karels, is can you talk about what your work could do to actually improve air quality before we have a fire like that?

Mr. KARELS. I don't think, from our end, we have the ability to improve air quality to start. What we do try to do is reduce the fuels ahead of time, so that do we tend to have less of those catastrophic events. I was there. I have seen your Lost Pines and the homes that were lost in that Bastrop fire. But doing the reduced fuel efforts, active management, prescribed fire, reduces the catastrophic events that we tend to have.

Now working very closely with EPA and with your States from my end, it is our State DEP, which is our State EPA, working closely with them, having smoke management plans and dealing with it, knowing the context for those exceptional events like that is the key in trying to, I think, reduce the impact, because, yes, I agree with you, that was very much an exceptional event, but we are forced, then, to come back and say we got to approve that. But with a wildfire that size, that should be something that should be done, should be something we should be able to easily approve.

Mr. OLSON. Any change you want from EPA to help you out with this effort to stop those fires like that that Bastrop county had in 2011?

Mr. KARELS. Could you repeat that?

Mr. OLSON. Any questions, something you would like EPA to do that they are not doing now to help you avoid something like we had in Bastrop?

Mr. KARELS. I think EPA, in at least some regions of the country, is better in recognizing that there are issues like prescribed fire that do cause particulate matter and do cause smoke, but it is needed to reduce the catastrophic events. So in some areas, they are starting to recognize that. That is what we want to do is recognize that doing treatments on the land is important to prevent these really bad days, air-pollution days that big wildfires cause.

Mr. OLSON. Thank you. I am running out of time. One other question for the record about the Western States Air Resources Council and the comment to the EPA's proposed revisions to the exceptional events rule and their quote was, "Ideally, EPA should work with State and Federal fire reporting agencies to develop a database of their emissions of significant wildfires." And so, I would like to submit it to you guys. Is that a good idea? Is that working? So we can get some intelligence beforehand how, we can stop these fires from getting out of control. Thank you. I yield back.

Mr. WALDEN. The gentleman yields back his time. So he is going to submit that question for you for response, and we will do a statement at the end of the hearing to tell you how many days. If you would do that, we would appreciate it.

The chair now recognizes Congressman Ruiz for 5 minutes, Dr. Ruiz, I should say.

Mr. RUIZ. Thank you. I appreciate it, Mr. Chairman.

Wildfires are a longstanding and frequent threat to western states, particularly California, and have only increased in intensity and frequency over the years. While wildfires present a clear threat to property and public safety, they also significantly affect, as we know, the air quality by increasing the number of toxic particulates in the air. The effects of smoke range from eye and respiratory irritation to more serious conditions like bronchitis, stunted lung development in children, increased asthma attacks, and even for some, premature death. So we need to find solutions to mitigate these public health risks before they become worse.

I work in the emergency department in the desert, and sometimes when patients come in with smoke inhalation, or if there is a wildfire, people with allergies, they come into the emergency department and not only it affects their own personal health, but as you can imagine, the economic burden for a community, for a family, and for society is really high.

In California, we all know that climate change has exacerbated severe weather patterns, and we are seeing more intense and more frequent fires. There are other factors that dry up or kill these vegetation and make them prone to burning as well. But there is more and more abundant fuel that make conditions ripe for uncontrollable wildfires, and that is exactly what has happened. Wildfires are more severe than ever before, forcing thousands of Southern California residents to flee their homes, putting at risk the lives of our men and women who are our heroes who go out to put out the fires.

In my area in the south coast, air quality management district, which manages the district I represent, has issued frequent smoke advisories this year, warning residents of the harmful air quality from the smoke and ash. Smoke that wafts over from wildfires in San Diego and Santa Barbara fills the sky of Coachella Valley, that

is the Palm Springs area in Southern California, endangering the health of my constituents. And although most wildfires occur in western States where the fires are large and numerous enough, the small particulates can be carried thousands of miles, and those small particulates, as you know, can cross the lung-blood barrier, so you breathe it in. Whatever goes in there goes straight into your blood. That can be very harmful for individuals across the Nation.

So without a doubt, the number and size of wildfires will continue to grow, so we have to consider more adaptive solutions and strategies.

Mr. Topik, you mentioned in your testimony that relatively small investments in our community's ability to prepare for and respond to fires has resulted in reduced negative impacts to the lives, health, and prosperity of our citizens. Can you expand on these small investments and their beneficial impacts on the public health, and also, the economic impact that we are saving?

Mr. TOPIK. Thank you. I think the answer is predicated upon this science that suggests controlled burns are going to have less harmful smoke than smoke would happen from wildfires. And so, given that, the kind of community activities—I had the unfortunate experience of going almost every year in the previous decade to Southern California during the fire disasters, including the time, 1 million people were evacuated in San Diego County and a score of people died, and so these are terrible situations. But getting communities, and in that case, some of the richer communities, Santa Fe, they had fire safe zones—they hadn't been able to plan ahead, and they had the resources to do it. Other places, we saw places where people just didn't have the resources. So getting the communities together, and I wanted to mention for Texas, the Austin area is one of the members of the Fire Adapted Communities Learning Network. And I think that is really important.

Mr. RUIZ. Can I ask you all some technical questions? There are different ways that we can prevent or mitigate future fires, but how about the wildfire resistant vegetation, how does that work, Mr. Karels? Planting these resistant vegetation, what are these resistant vegetation? How much of an impact does that make?

Mr. KARELS. And you are able to get it in each state, look at, they will put a brochure out, and some vegetation burns readily and is very dangerous to be close to your homes, and other vegetation doesn't, and that is what they call fire-resistant vegetation, just types of vegetation that doesn't readily burn. They also incorporate that in with defensible space, and that means moving the vegetation that does burn away from your homes a minimum of 30 feet, ideally more than that, to prevent home loss. So that is kind of what that fire resistant vegetation is. State of California would give you those plants that are less likely to burn that are good around your homes.

Mr. RUIZ. Thank you.

Mr. WALDEN. The gentleman yields back his time. The chair now recognizes the gentleman from Ohio, Mr. Johnson, for 5 minutes.

Mr. JOHNSON. Thank you, Mr. Chairman. I appreciate the recognition. Important topic that we are talking about today.

Mr. Karels, the EPA has tightened national ambient air quality standards for ozone and particulate matter in the last few years.

Do lower air quality standards make it more difficult for fire managers to pursue effective fire management policies?

Mr. KARELS. They can. However, if ahead of time, you have your partners, you do in your state—and this is a state-by-state issue, even though we are dealing with EPA—it is a state-by-state issue. If you have your smoke management plan that you worked with your state EPA, and from our end we also work with our state highway patrol because of the safety issues of smoke on the highway. And we developed together those three agencies' smoke management plans that EPA then approves, and with that approval, that brings everybody together in that partnership.

Fire doesn't know any boundaries, so just about everything we do to reduce the threat, whether it be air pollution or a threat to our forests or communities has to be partnerships from the Federal, state, and local.

Mr. JOHNSON. All right. So how can wildfire emissions affect an area's ability to comply with these national air quality standards?

Mr. KARELS. If a wildfire would exceed those air quality standards, you have exceedance, and then you have, as a state agency, as a state, you have to then go to EPA and say this was a wildfire event and prove that that reason that air quality had an exceedance, or in other words, a bad air quality day, was because of those wildfires. But you have to work with EPA and your local state environmental protection to deal with that exceedance issue.

Mr. JOHNSON. OK. And maybe you just answered this, but if they cannot comply for whatever reason, what then happens? Are they fined? Is there some penalty?

Mr. KARELS. If they can't comply, and what EPA then—and I am not the expert on this, I have to be very careful—one of the three of you are any better at it? I am more than willing to give it.

EPA can come in and say this is an impact area. I am forgetting the terminology they use. That then makes you adjust what smoke and what air quality issue you have in that area. So if it is a wildfire, you always want to come back, and if it is a wildfire that exceeds EPA's requirements for air quality, you want to come back in and work with them to not put this as an area that then has future economic issues with all air quality issues.

Mr. JOHNSON. OK. All right. Well, you note that—and I quote out of your testimony, "The task for wildfire managers is to manage the risks to communities and ecosystem values in both the short-term and long-term by implementing a coordinated and science-based program of fuels reduction, fire suppression, and community planning." Tell me more about community planning.

Mr. KARELS. As I said earlier, fire knows no boundaries, so whether that fire comes from state jurisdiction or Federal jurisdiction, it comes into that community, that community has to be prepared, too. Just like you want under the national cohesive strategy for wildfire, you want fire-resilient landscapes. You also want fire resilient communities, communities that are prepared for fire, especially in the west where it is something that you see significantly. They are prepared for fire. They know they have a plan. They have the strategic boundaries to treat strategic fuel breaks. They know what to do in the way of evacuations. They have defensible space. All of that is fire planning, as well as the suppression effort. The

local fire department, the state jurisdiction, and the Federal jurisdiction are all working together ahead of time so they have a good response. That is that community planning that helps to reduce that threat to the community.

Mr. JOHNSON. OK. In the short amount of time, would any of the other panelists like to comment on community planning?

Mr. BAILEY. I will always take an opportunity to talk. When we came back to this idea of fire-resistant vegetation and all that kind of stuff, the only thing I would add to that is, fire-wise construction of the actual homes that are in the community and getting the community on board and supporting each other to do that work, because often, if you can bring in one dump truck and get rid of a bunch of things that will get a bunch of neighbors together to clean their gutters, all the weeds underneath their deck and all that kind of thing, because as often as not, I see houses catching fires and burning up the vegetation, rather than the vegetation catching on fire and burning the house.

Mr. JOHNSON. Got you. OK. Well, thank you. Mr. Chairman, I yield back.

Mr. WALDEN. The gentleman's time is expired. We have a lot of Californians on this committee, so another Californian, Congressman Cárdenas, from Los Angeles, you are recognized for 5 minutes.

Mr. CÁRDENAS. Thank you very much. Can one of you gentlemen help clarify if this statement is true, that the States are not penalized in the event of a wildfire because of EPA's exceptional events rule, and as well, are exempt when there is a controlled burn as long as there is a smoke management? Is that afforded to the states? Is that an accurate statement?

Mr. BAILEY. It is outside of my area. I know that when the exceedances, or when you apply for that extraordinary event kind of thing and it is denied, it becomes an exceedance, and they somehow accumulate and all that kind of stuff. The problem, in my mind, is that the wildfire smoke is largely unregulated, whereas the small amount of prescribed smoke is regulated. And so if that is the only thing that you can regulate, including like your child's behavior, if there is only one little thing that you can do, that is what you crank down, and yet all this crazy other stuff is going on that you have no control over.

Mr. CÁRDENAS. So apparently, the exemption exists. It doesn't mean if you applied that you are going to get it. That is the issue. OK.

I constantly think about our responsibility as a community, whether it is private-public sector, et cetera, private property, public property, is pay now or pay later. I think that this dialogue that we are having today, there is a dynamic of pay now or pay later. If we can do prevention and intervention, et cetera, whatever government it is, whether it is local government or assistance by the Federal Government to help with that prevention, I think that what we will have is less wildfires, less catastrophe, less need to ask for an exemption by the EPA, et cetera.

So I think that the question begs is have we had, in recent time, in the last 10 or 15 years, any decent or expansive cost-benefit analysis at the Federal level? And/or have we seen any really good studies at the state or local level that we can actually apply across

jurisdictions, so we can actually, maybe, start encouraging and/or helping with best practices?

Mr. BAILEY. I think most of the studies are going to be a smaller scale. It is not something you would call a comprehensive national assessment of whether the National Fire Plan money or the Hazardous Fuel Reduction Act paid for itself or so, I haven't seen that, but certainly, I have seen the smaller-scale analyses.

Mr. CÁRDENAS. So it sounds like some jurisdictions have taken upon themselves to try to figure out if they can get at some best-practice proof, but it sounds like, from what your answer is, that at the Federal level, we haven't funded a nice, comprehensive study, at least in our lifetimes of considering these issues?

Mr. BAILEY. Or I haven't seen it. I don't know, Chris?

Mr. CÁRDENAS. That is what I am saying. There is a lot of collective knowledge here at the table, there is not an absolute answer, but it sounds like we really haven't seen that sponsored from the Federal level, again, by the collective folks that we have in front of us.

Mr. TOPIK. Just briefly, I think we need more of that study, but there is some really good work done at Northern Arizona University Ecological Restoration Institute that was done directly for the OMB to help address some of these questions looking at the successful impacts of hazardous fuel reduction, and so, I commend the work of those folks. It is quite pertinent to this.

Mr. CÁRDENAS. Mr. Topik, can you explain the process for cleaning up fuel loads on private lands, and also on Federal lands? And what about companies' utilities that have easements on public lands? What is the climate like right now when it comes to that activity?

Mr. TOPIK. With respect to the utilities, that is really important. It is exciting to see, for instance, in Colorado, Xcel Energy partnering with the forest service and other large landowners to get work done on a broader scale, not just under their rights of way, but areas near their rights of ways. And so, those kind of partnering, Denver Water, helping commit monies to protect—there is so much room to also then bring together corporate money, and new financial instruments. There are people developing resilience bonds for impact investing. So there is a lot of things that are out there, but there is a lot of need for more of that.

Mr. CÁRDENAS. So you just described some good practices of pay now rather than pay later. For example, when it comes to utilities aren't down power lines the cause of sometimes some tremendous fires, because of downed power lines? And with all due respect, if that utility is screaming bloody murder like, Hey, can we please get in there and actually cut back so we don't have that incident occur, and if they are thwarted, then oops, we may have a wildfire that could have been prevented, correct?

Mr. TOPIK. I definitely support utilities having ready access to keep control.

Mr. CÁRDENAS. Thank you. I yield back my time.

Mr. WALDEN. The gentleman's time is expired. The chair now recognizes the gentleman from North Carolina, Mr. Hudson, for 5 minutes.

Mr. HUDSON. Thank you, Mr. Chairman, and thank you for calling this very important hearing. And thank you to all the witnesses for excellent testimony. This is certainly an important issue, not just for the west, but all across the country, and, back home in North Carolina, we like to talk about common sense, and I think this really just boils down to the Federal Government allowing commonsense practices and then the kind of things that you have talked about. Mr. Karels, did I say that correctly?

Mr. KARELS. Karels.

Mr. HUDSON. Correct me. Karels. I am sorry. You mentioned in your testimony the Good Neighbor authority. You talked about the Good Neighbor authority allows states to engage in work on Federal lands, including increasing the opportunities for the Federal forest management activity by using state resources. In my district in North Carolina, we have the Uwharrie National Forest, and we have seen, in the case of our forest, many of the roads have degraded significantly, and with travel, age, elements. I have seen, firsthand, this is more than just a headache for residents that have to use the forest road to access their homes, but it is a real safety issue, because fire trucks and ambulances can't get down these roads when we have major rainstorms. So it is a real safety issue for us.

And my understanding is the Good Neighbor authority currently is limited because there is a prohibition on all roadwork, even repair and maintenance and reconstruction activities on existing forest service roads, which, as you know, are key parts of forest management activities. What kind of real-world problems have you encountered in your state because of prohibitions of roadwork with the Good Neighbor program?

Mr. KARELS. In our state we signed the Good Neighbor authority agreement with both the national forest in Florida, and actually the national forest in Alabama. We are a little bit oddball that we would sign with adjoining state, but they butt up against a very large state forest we have.

If you are going to do activity in the forest, fuel reduction, forest thinnings, any of that, you have to maintain the roads. For us in the south, those roads are sandy. Those log trucks will quickly sink down, and if you are not able to at least keep them to a minimum standard to move equipment back and forth, you can't accomplish the task. So that is a limitation. It is very much a limitation in the west. This Good Neighbor program is an excellent program, and it is growing over—I think over 30 states have signed in. A lot of projects are starting. But we can continue to improve it, and your thoughts are right online in the ways that we can improve it with the next farm bill, or whatever that may be.

Mr. HUDSON. So in your opinion, if we can do a legislative fix to allow roadwork to be part of that, that would be an improvement?

Mr. KARELS. At least maintaining those roads, yes.

Mr. HUDSON. Anybody else want to jump in on there? I am seeing nods.

Mr. MARSHALL. I would definitely agree. We see circumstances where the roads potentially have even been abandoned, and it makes it very difficult to put a full-front attack on stopping a fire, especially even in the instance where it could be a community or,

public or private resource is impacted. So certainly, that would help a lot to be able to address the roads and have that part of the Good Neighbor authority.

Mr. HUDSON. I appreciate that. And even beyond the safety interests, if you are concerned about erosion and the impact, and even particulate matter in the atmosphere. In many cases, being able to pave a road is better than having a gravel road that is deteriorated and you have got lots of environmental impact. So anyway, I appreciate your thoughts on that.

Mr. Chairman, I yield back.

Mr. WALDEN. The gentleman yields back his time. The chair recognizes the gentleman from Michigan, Mr. Walberg, for 5 minutes.

Mr. WALBERG. Thank you, Mr. Chairman, and thanks for having this hearing. I had the good privilege to be out in Montana and Wyoming in August, and performing a wedding ceremony of one of my staffers out there, and with a backdrop of West Glacier a little hazy, a little hazy. Two weeks later, they closed it off. Heading down a few days after that to Yellowstone and the Grand Tetons, and out to the Big Horns and seeing still all of the haze there from the fires and smelling the smoke in certain places, very concerning.

I have seen too much of that happening, and if there are ways that we can get a handle on it, and use appropriate forestry tactics to make sure that the forests grow well, and we have the resources continued, that is a great thing, but it just seems like that we are seeing these resources subdued by fire and other things. So I appreciate this hearing today.

Some states seem to be doing better than others in reducing the risk, and, Mr. Karels, is this due to differences in the way states approach management? And are there lessons from states that have lower wildfire risks that can be applied to states with higher risk?

Mr. KARELS. Any state can have a high risk, whether it be Michigan, Florida, or Oregon, depending on a given year. Some of the benefits are the state laws that are in place that allow you to do these treatments on a larger scale, and I really look at it on a larger scale, landscape scale to make a difference. So the laws that are in place many times are one of the key issues of being able to implement those treatments on a landscape scale size. States and regions are very different. I can say Florida does a lot of prescribed fire, and they do. And saying Oregon should do the exact same thing is all but impossible because of the different geographic areas, the different mountainous terrains and all that, but the laws that allow you to do it at the right time are critical in each of those states, and go back to that partnership issue. It takes the efforts of all the agencies coming together. I was in discussion with California not that long ago on this same issue of how do you work to increase your fuel reduction with prescribed fire, and what laws do you have to have in place to make this effective? And it really takes all those agencies involved in a partnership to do this.

Mr. WALBERG. Let me jump on that a little bit. You know that culture fire suppression has led to the buildup of hazardous fuels to historic levels. If you could snap your fingers and change Federal policies, get to us, reduce red tape and improve coordination, how long would it take to see meaningful reduction in the wildfire risk?

And I open this up to the others on the panel, too, but, Mr. Karels, I will give you first shot on it.

Mr. KARELS. If I could snap my fingers and say we can do everything we possibly can right now, we are going to get better, but it is going to take years. It is going to take years. It is going to take education with the citizens in those areas. But the opportunities to reduce that threat are significantly there. I want to give you a quick example.

About 33 years ago I worked on the Black Hills National Forest in South Dakota, and we had a very active forest management program, and we had an active fire program, and we did a fair amount of prescribed burning in that Ponderosa Pond ecosystem. I went back there 2 years ago, the first time in 33 years, 31 years later, and I could not believe the difference in that forest in the density and the fuels, and a lot of that is active management. It has taken us 31 years to get there in that case. If we could snap our finger, maybe we could start turning the corner in 5 to 10 years, but that would just be my estimate.

Mr. BAILEY. It is a big backlog. It is a big debt to pay back in terms of the biomass accumulation across the landscape and the smoke that is hidden in that biomass that is going to be released, so it is going to be a big effort. I have been involved in a big, comprehensive modeling effort that looked at even quadrupling the rate of treatment, which I would do if I were made king, but it is still going to be years, decades to pay back that debt.

Mr. WALBERG. Well, I appreciate that, and I know my time is expired, but those are resources we sometimes forget about, and hurricanes and all that go on are a tragic loss, but I think of all that went on out west this summer as well that we didn't hear all that much about, but it was impacting our country, its citizens' enjoyment of those resources, et cetera, for an awful long time. So hopefully we can get it taken care of. Thank you.

Mr. WALDEN. The gentleman yields back the time. The chair now recognizes the gentleman from West Virginia, Mr. McKinley, for 5 minutes.

Mr. MCKINLEY. Thank you, Mr. Chairman, and thank you for this particular panel and this hearing, because numbers of us have been talking about the effect that deforestation has on a climate change, and you have heard some from the other side make that comment about climate change, and NPR just made a statement the other day that said, again, it is kind of axiomatic, but they said that deforestation is a major contributor to climate change.

I think a lot of us would agree Al Gore's book talks about 25 to 30 percent of the anthropogenic global warming is contributed from the deforestation around the world, 25 to 30 percent. Interestingly enough, putting that in perspective, that is five to six times the percent contributed from fossil fuels, from coal. So instead of dealing with this deforestation and forest fires, Congress has been spending the last 10 years fighting coal.

So I am delighted that we are having this adult conversation about our forests, and how we can protect them. We know in the Amazon, in 2014 they had 1,900 square miles they deforested. The next year they increased 24 percent. They went up to 2,300, and this last year they went up another 29 percent, and there is where

that deforestation is taking place in one of the major areas after almost 3,000 square miles is being deforested.

But in America, we are still attacking fossil fuels rather than addressing this larger issue. And then, I am trying to avoid for West Virginia the fires like you are seeing in all the photographs here have been about Oregon. And we have the Monongahela National Forest in the southeast portion of the state that has been considered by some, it has become a nursing home for trees, because for whatever has happened over the years, the forester division has not been thinning that out.

And so I am very curious, I know I am not going to hold you to the 28 trees per acre up to a thousand, that is just a grab number, and that is fine. I don't know what the number should be, but I know that the Allegheny National Forest in Pennsylvania has dramatically thinned out its crop, but we are not doing that in West Virginia. We are allowing it essentially to continue to grow older and older and older, and we are not thinning that out.

When the answer to Harper's question was timber management, it could reduce forest fires. If that is the case, to protect West Virginia's forest, how could I get our national forest to thin out the MOG? Or am I going to experience a fire like you are having in Oregon?

Mr. BAILEY. It is more complex I think than just asking them to thin out the forest. It is to get them to view it comprehensively, including, as a fuel and as a fuel bed for some potential fire, particularly in an extreme drought year like the Gatlinburg area got this past year or, of course, something like that, because that forest will burn. It is capable of burning, as well. And this is not actually about deforestation, at least in the United States. Long ago, we kind of turned that corner and said we weren't going to deforest, which is a land use change to something else.

We manage our forests extremely well thanks to our laws here, and deforestation in the U.S. is really different. And even the wildfires themselves are not deforestation. Even clear cutting in the history of the Monongahela, that is not clear cutting. All those areas will be forests again. And so it doesn't contribute to that part of the message about climate change and deforestation. And they the best way to go is sustainable management that is resilient to the fires that are going to——

Mr. MCKINLEY. I just want to see that we have some timber management in the MOG. I am trying to find ways how to take care because otherwise I think we are going to have a real problem here in that upcoming future. So I thank you and I yield back.

Mr. WALDEN. The gentleman's time is expired. The chair now recognizes the gentleman from Georgia, Mr. Carter, for 5 minutes.

Mr. CARTER. Thank you, Mr. Chairman. Mr. Chairman, I want to thank you for having this hearing. This is extremely important, as you know, and as I want the panelists to know, who I also appreciate being here, I represent southeast Georgia. I represent the entire coast of Georgia and almost half of the Georgia-Florida State line. The West Mims Fire was in my district, Mr. Karels, so this is something I am very familiar with. Help me to understand, not all forest fires are the same, especially in the swamp, because as I understand it, and correct me if I am wrong, the peat catches on

fire, and it is underneath, and when you put water on it you can't necessarily put it out because the water table has to rise enough to get it out underneath, so it smolders for a longer time. Is that right?

Mr. KARELS. Yes. All the way to North Carolina, Florida, Georgia, North Carolina, Minnesota, Michigan, you have peat or what we call muck fires, pocosin fires, and those are organic soils that are burning. And in the swamp in your district, that West Mims Fire was the Okefenokee swamp. We have tried for 30 years to suppress fires, and then we figured out going into the swamp is just throwing money away, and both the Federal Government and the State government actually figured that out. And what we have done is put what is called swamp's edge break around that 600,000-acre essentially wilderness, managed by U.S. Fish & Wildlife.

The one thing that I think is a shining star there that can be looked at all across the country is we have what is called the Great Okefenokee Association of Landowners. That is state agencies, Georgia and Florida, that is Federal agencies, Fish & Wildlife, U.S. Forest Service. But the key is that is all the private timber companies around there as well, and they all are in this together fighting fire and dealing with this situation that really expands those partnerships, and in most cases, works very well. We struggled this year with it, and we are coming back and looking at how do we improve on it, but that organization is ideal organizations to implement in the west, too. Where you bring everybody together and everybody has a voice.

Mr. CARTER. Now, you just mentioned something I want to ask you about. As I understand it, the West Mims Fire was started by lightning. It started in the Okefenokee National Forest, and the Federal Government didn't do anything until it started to get to the edges where it would impact the private landowners. They said they wanted it to burn. Is that the policy?

Mr. KARELS. It isn't always that they want it to burn, but it is good for the swamp to burn, but backing, and that is the U.S. Fish & Wildlife Service. Backing them is that we have, since the 1980s, tried to go in and put those fires out in the swamp. You can't get people and equipment in there, so you mostly are dropping it with expansive air operations, and you can't put the fire out in that peat with that. So essentially when those fires start out there, we prepare on the outside almost like a prescribed burn. We start to build our lines and begin the suppression effort around the swamp, rather than go in and try to fight it, knowing that we can't put it out in that swamp.

Mr. CARTER. All right. Two things real quickly. First of all, you said earlier that the states have the plans for preventative burning and everything, and they are approved by the EPA. What about in the national forests like the Okefenokee, is that still done by the State of Georgia, or is that done by EPA itself or who?

Mr. KARELS. Well, each State is different, but, for example, in Florida because we implement the Clean Air Act for our Department of Environmental Protection with EPA, the National Forest and all the Federal agencies come to us for an authorization to burn. So we oversee that program even for the Federal agencies as

well, and that is a little bit different in each State. Georgia does the same thing. So the Fish & Wildlife if they have got to get a prescribed burn, they go to the State of Georgia.

Mr. CARTER. Did they ever do a prescribed burn in the Okefenokee?

Mr. KARELS. They do on the edges in the uplands on the edges.

Mr. CARTER. But it is such an enormous area.

Mr. KARELS. Again, most of the Okefenokee is in Georgia, so I don't watch it on a day-to-day basis, but what they try to be careful of is they don't put it into areas where they know that it may, with weather changes, continue to burn until it becomes a catastrophic fire.

Mr. CARTER. Well, Georgia is the number one forestry state in the Nation. I mean, this is extremely important to our state, especially to my district. I don't know if this will make you feel any better, and it probably won't, but this is not an uncommon problem that we are dealing with in that getting funding for preventative measures, almost across the board, is difficult a lot of times. I am a healthcare expert, and it is difficult to convince Congress sometimes if we will just put money toward this, it will save us so much down the line, and the same thing with the preventative burning and all the things we can do in forestry. In all fairness to Members of Congress, we are just trying to put out fires, so to speak, with our budgets.

Mr. WALDEN. OK. Time is expired.

Mr. CARTER. I just wanted to make sure I got that in, Mr. Chairman, and I yield.

Mr. WALDEN. The gentleman's time is expired. So we heard from the next gentleman early in the hearing, and he has been here the whole time. Congressman Kurt Schrader was very excited to be able to attend and participate in this hearing because of the challenges that the State of Oregon has. I appreciate him being here the whole time, and now I yield to him for 5 minutes.

Mr. SCHRADER. I appreciate it very much, Mr. Chairman, and this is a really important hearing, and I appreciate all the witnesses making the trek out here, and I love my fellow Congressman from Georgia, and I would agree that Georgia does a heck of a lot of timber, almost as much as the great State of Oregon. And we would like to do more; Georgia has a little friendlier environment, which I would like to get to on our side of the continental divide.

Just for the record, the photo I put up, that is 48,000 acres, folks. That is 48,000 acres. And it is only 46 percent contained, and it is supposed to burn until Christmas. It will continue to burn until Christmas. The train is so steep, it is tough to put out, if you will. So this is an ongoing problem that started on Labor Day, and it will burn for basically 3, 4 months here.

So this is a real big issue, and I am glad the panel is here and we are attending to it. I would like to reemphasize the fact that forest mortality is an issue, too. The wildfires are a big deal, and for short periods of time, they put out horrible emissions. The chairman himself had a jar full of that ash that fell over the biggest city in the State of Oregon called Portland, Oregon, and that brought it home to a lot of my Portlandia folks that this is real.

This is real, and it is right next door. That fire was next to Greg's home. It is just a few miles away from Portland at the same time.

Dr. Bailey, prescribed fire, glad to hear that seems to be unanimous treatment that we should be employing, perhaps more of. In some areas it is easier than others. In some areas the overgrowth is pretty thick, and I assume some thinning would have to be done before we could get to prescribed fires. Is that accurate?

Mr. BAILEY. Yes. And I think, in fairness to Mr. Marshall, that is going to be primarily Federal lands, where it is longer rotations, uneven age management, broad management objectives. Some mechanical thinning, partial harvesting, followed by prescribed firing is the way I see the solution, and I think the research supports that.

On private land, really, the opportunity to treat these fuels is at the end of the rotation and before you start another one. And so, for them, we are talking about very effective site preparation burning.

Mr. SCHRADER. OK.

Mr. BAILEY. But that site prep burning has gone away for many companies in many parts of the Oregon landscape because of the air quality management rules.

Mr. SCHRADER. Right, that seem to be backwards, as we heard here today.

Mr. Marshall, I would like to have you comment a little bit about the culture of the Forest Service. Apparently, there is great variation. I know the categorical exclusions we put in the farm bill were categorically denied by a good friend of mine in the great State of Washington and has seen little use in that state as a result. I know our own state forester is not a fan of categorical exclusions to treat some of the salvage issues and some of the real problems we have in our state.

And I guess I am worried about the culture of the Forest Service itself. Have you seen any change, in your experience, sir?

Mr. MARSHALL. The culture encompasses a wide spectrum of philosophy. We do see, within the same region, Region 6, the most familiar that I am with——

Mr. SCHRADER. Sure.

Mr. MARSHALL [continuing]. We see areas where they are very aggressive, very proactive, very engaged with The Nature Conservancy and others, and moving forward with good projects, good outcomes, good outputs, for the industries in those areas. We do see other areas where it diminishes rapidly.

And it is a tough culture to change, in my opinion. You see those cultures, and you want support to move them forward. And we are, through collaborative efforts—I am on the Olympic Peninsula Collaborative myself—trying to make those opportunities and educational process to change the culture.

But it is difficult. I am seeing personally, it is easier to change the culture of maybe some of the opponents than it is maybe with some of the agencies. We need leadership. We need the people in this room to direct those leaderships to get those cultures in line with focusing on good outcomes that all four of us here agree on.

Mr. SCHRADER. I would agree. I think there is great variation. And, hopefully, with the right leadership in the various regions, we can get to that. I think that would be critical.

Dr. Topik, constant litigation is the bane of forest management in the Pacific Northwest. Without changing that, we are doomed to a cycle of rural poverty the likes of which this country has never seen before. It is absolutely unconscionable, what goes on there. Every single project gets sued by some radical environmental organization—thank God, not The Nature Conservancy—and it becomes impossible to do the smallest of projects out there.

It would seem to me that there is some middle ground here, as you all have talked about, appropriate give-and-take, judicial review perhaps on the front end of a forest management plan or a landscape portion of a management plan.

But do you think it is reasonable, after we have gone through that battle and come to some accommodation, some collaboration hopefully, that it is fair to litigate on every single project within that management plan?

Mr. TOPIK. Well, I certainly don't favor frivolous litigation and lawsuits, by any stretch of the imagination. I am nervous about giving special treatment to some areas.

Oregon now has, what, 38 collaboratives underway in eastern Oregon alone? And you are not seeing the litigation on these.

So I think a little bit of investment would be one heck of a lot cheaper than dealing with the lawsuits. So that is something I would like to see us invest in.

Mr. SCHRADER. Very good.

Before I yield back, if I may, Mr. Chair, there is legislation out there that is talking about maybe using arbitration as an alternative to the constant litigation, particularly once these large forest plans and landscape management plans have been approved.

We, again, want to make sure that everyone gets a chance to collaborate and have their 2 cents at the table, but, unfortunately, there are very unreasonable people still out there that make it difficult to get to that. And I urge this committee and others to be thinking about perhaps an alternate way to get to some accommodation at the end of the day.

And I really appreciate you having this hearing, Mr. Chairman and Mr. Ranking Member. Thank you so much.

Mr. SHIMKUS. Dr. Topik, go ahead and respond.

Mr. TOPIK. Was there time to comment briefly on——

Mr. SCHRADER. Yes, sure.

Mr. TOPIK. I want to see negotiated settlements where you bring parties together and have a judge or an arbiter, whoever, come up with new and novel solutions. The legislation that I have seen doesn't allow that. It allows either this or that and doesn't allow—so I think the concept is sound. I think some of the details need fixing.

Mr. SHIMKUS. The gentleman's time has expired. Thank you.

Thank you, panel, for being here.

Seeing that there are no further members wishing to ask questions for this panel, I would like to thank you all for being here.

Before we conclude, I would like to ask for unanimous consent to submit the following documents for the record: a letter from the

Western Governors' Association; the National Climate Assessment 2014, chapter 7 on forests; EPA, "Climate Change Indicators in the United States: Wildfires"; Climate Central report, "Western Wildfires: A Fiery Future"; Climate Central articles "Wildfire Season is Scorching the West," "With Warming, Western Fires May Sicken More People," "Climate Change Behind Surge in Western Wildfires"; Christian Science Monitor; San Diego Tribune, "Climate Change Expected to Fuel Larger Forest Fires—If It Hasn't Already"—you guys are on this climate change thing, aren't you?—Union of Concerned Scientists, "Heat Waves and Wildfire Signal Warning about Climate Change (and Budget Cuts)"; Yale Environment 360, "A Warmer World is Sparking More and Bigger Wildfires."

Without objection, so ordered.

[The information appears at the conclusion of the hearing.]

Mr. SHIMKUS. Again, we appreciate it. We have learned a lot. I think I get a college credit now for Wildfires 101 in my forestry class. So we would like to again thank you.

And the hearing is adjourned.

[Whereupon, at 12:08 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

WESTERN GOVERNORS ASSOCIATION

DENNIS DAUGAARD
GOVERNOR OF SOUTH DAKOTA
CHAIR

DAVID IGE
GOVERNOR OF HAWAII
VICE CHAIR

JAMES D. OGSBURY
EXECUTIVE DIRECTOR

October 3, 2017

Honorable John Shimkus
Chairman
Subcommittee on Environment
Committee on Energy & Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20515

Honorable Paul Tonko
Ranking Member
Subcommittee on Environment
Committee on Energy & Commerce
U.S. House of Representatives
2125 Rayburn House Office Building
Washington, D.C. 20510

Dear Chairman Shimkus and Ranking Member Tonko:

Western Governors appreciate the attention you are bringing to the impacts of wildfires on air quality and emissions in tomorrow's Subcommittee hearing. To inform the Subcommittee's consideration of this subject, I request that the following attachments be included in the permanent record of the hearing:

- The August 11, 2016 letter from Western Governors to the Environmental Protection Agency (EPA), Office of Information and Regulatory Affairs, and the White House discussing background ozone in the West and the Exceptional Events Rule; and

- The February 3, 2016 letter from Western Governors to EPA articulating concerns regarding the retention of the "not reasonably controllable or preventable" criterion and the deference accorded to federal land managers and federal fire managers in the proposed Exceptional Events Rule and Draft Guidance.

Thank you for your consideration of this request.

Respectfully,

James D. Ogsbury
Executive Director

Attachments

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August 11, 2016

Honorable Gina McCarthy
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Dr. Howard A. Shelanski
Administrator, Office of Information and Regulatory Affairs
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Brian C. Deese
Assistant to the President and Senior Adviser
The White House
1600 Pennsylvania Avenue, NW
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Re: Background Ozone in the Western United States and the Exceptional Events Rule

Dear Administrator McCarthy, Administrator Shelanski, and Mr. Deese:

Western Governors write regarding final revisions to the Environmental Protection Agency's (EPA) Exceptional Events Rule (EER) which is now undergoing White House Review. Western Governors are concerned that the EPA decision to lower the National Ambient Air Quality Standard (NAAQS) for ground-level ozone under the Clean Air Act (CAA) is likely to cause areas in the West to enter non-attainment status based on high levels of uncontrollable background ozone through the final EER. We strongly urge EPA to adjust criteria to properly account for events that contribute to background ozone concentrations, which are impossible for states to control.

The CAA obligates all states to develop State Implementation Plans (SIPs) to attain and maintain the NAAQS. SIPs are intended to reduce emissions only from sources over which states can exert control, not including natural or international sources. However, various events and conditions result in elevated levels of background ozone, which states cannot and are not expected to control. Such events and conditions include wildfire, lightning, biogenic emissions, stratospheric ozone intrusion, and transported ozone from international and

interstate sources. These events may be discrete (such as a wildfire or stratospheric intrusion) or may present as a periodic or ongoing condition (such as transported ozone). All result in emissions over which states have no control. Comments submitted to EPA by the Western States Air Resources Council (WESTAR) artfully elaborate challenges faced by western states as a result of these background ozone contributors and are supported by Western Governors.[1]

Upon lowering the NAAQS for ground-level ozone in 2015, EPA affirmed that, "[u]nder the [CAA] states are not responsible for reducing emissions from background sources."[2] The agency recognized that certain areas of the West are particularly susceptible to high background ozone levels and pledged to, "work directly with responsible air management agencies in these areas to ensure that all CAA provisions that would provide regulatory relief associated with background ozone are recognized."[3]

Western Governors value the agency's statements from late 2015. As stated in WGA Policy Resolution 2014-13, *State Clean Air Act Authority and Air Quality Regulation*, Western Governors believe EPA should engage states as co-regulators and should ensure state agencies and representatives have a robust voice and play a meaningful role in any EPA rule promulgated under the CAA.[4] We recognize the critical importance of maintaining air quality in the West and appreciate the opportunity to work with EPA to achieve this.

In that regard, Western Governors have significant concerns over the lack of CAA tools available to account for ozone NAAQS exceedances resulting from factors outside state control. As noted in the EPA Memorandum, the CAA contains provisions to ensure states must address only man-made sources within their jurisdiction and must impose emissions controls only to the extent they are reasonably available.[5] The existing regulatory framework, however, lacks effective tools to identify emission sources outside state control. Methods of accounting for background ozone sources identified by the EPA are insufficient.

In addition, although the proposed EER can be useful to account for ozone contribution from discrete events such as wildfires and stratospheric intrusion, the rule could be improved.

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[1] May 11, 2016 Comments from WESTAR to EPA, *Western States Responses Regarding Background Ozone and Recommendations for Additional Efforts in the Western U.S.* Available here.

[2] October 1, 2015 Memorandum from Janet G. McCabe, Acting Assistant Administrator, EPA Office of Air and Radiation, to Regional Administrators, Region 1-10, Paragraph D of Attachment (EPA Memorandum).

[3] *Id.*

[4] Section B(1)(a) of WGA Policy Resolution 2014-13. Attached and incorporated by reference.

[5] *Id.*

Western Governors suggested several such improvements in our February 3, 2016 comments in response to EPA's proposal.[6]

Even with our suggested improvements, however, the EER is not an adequate mechanism to account for factors such as lightning, biogenic sources and transported ozone. These sources are inherently difficult to measure and establish in a state's exceptional event demonstration. Identifying and quantifying the role of these factors and making a judgment about their relative importance is an onerous, if not impossible, undertaking. Prior to implementation of the NAAQS for ozone and before finalization of the revised EER, it is vital that EPA recognize the inadequacy of CAA mechanisms states have at their disposal to account for ozone-contributing factors outside state control and develop a more workable framework.

Western Governors believe the states – and in turn EPA – would benefit from a more holistic approach under which states could aggregate multiple ozone-contributing factors to prove a single exceptional event exceedance demonstration. This approach would be in line with EPA's shift to a "Clear Causal Relationship" standard outlined EPA's proposed revisions to the EER.[7] Under such an approach, there would be no onerous requirement to differentiate and quantify contributions of various background sources or to utilize multiple CAA provisions to account for various background ozone contributors. Rather, the focus would be on showing that these sources, rather than controllable man-made emissions, are the principal contributing factor in a monitored NAAQS exceedance.

A potential path to implement this approach would be:

- Revision to the EER so that, either individually or in the aggregate, all factors contributing to high background ozone levels could be considered as "exceptional events," for which states are not held responsible.

- The approach could also be incorporated into Appendix U of the CAA, which sets out the methodologies EPA uses to interpret exceedances of the ground-level ozone NAAQS and assess factors contributing to NAAQS exceedances.

Western Governors are supportive of efforts by WESTAR and EPA to collaborate to address issues posed by background ozone in the West. Western Governors would like to be helpful in the development in this process. We look forward to working with EPA and other partners. We believe development of a state-EPA collaborative workplan with defined timelines

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[6] Attached and incorporated by reference.
[7] Section V(B)(c) of proposed EER.

consistent with this letter, the EPA Memorandum, and WGA Policy Resolution 2014-13 would be a positive step toward state and federal partnership on the issue of background ozone in the West. Western Governors will be following up to assure that its views are considered during final review of the EER revisions.

Sincerely,

Steve Bullock
Governor of Montana
Chair, WGA

Dennis Daugaard
Governor of South Dakota
Vice Chair, WGA

cc: Janet McCabe, Acting Assistant Administrator for Air and Radiation, EPA

WESTERN GOVERNORS' ASSOCIATION

Western Governors' Association
Policy Resolution 2014-13

State Clean Air Act Authority and Air Quality Regulation

A. **BACKGROUND**

1. Clean air is essential to strong communities and quality of life. Various factors, some of which are caused by anthropogenic activities and some by natural phenomena, influence air quality in the West.

2. The Clean Air Act (CAA), which established a regulatory structure for monitoring and improving air quality, is premised on a system of cooperative federalism under which states and the Environmental Protection Agency (EPA) work together as co-regulators.

3. States have statutorily recognized authority to manage air quality within their borders. The CAA recognizes that states should take a lead role in implementing various provisions of the Act, largely because factors affecting air quality often differ based on local industry, geography, population, meteorology and other state-specific or regional factors.

4. In addition, many Western states have requested and been granted broad delegated authority to implement CAA programs. Under the delegated authority framework, a state may assume primary responsibility for the development, implementation, and enforcement of CAA requirements, using an approach that makes sense within its jurisdiction, subject to minimum requirements established by EPA.

5. Delegated authority is particularly important in the West. The region's unique aspects – extreme variations in geological features, a largely arid climate, vast areas of high altitude, and vacillating weather patterns -- influence the movement, composition, and quality of air. Many Western states are also home to industrial operations and growing population bases, which impact air quality in the region.

6. Western Governors recognize the value and strength of cooperative federalism in air quality management and also believe the current relationship can be improved. Federal agencies are increasingly challenging state implementation plans (SIPs), asserting additional federal regulation or oversight, and often requiring duplicative documentation. These federal actions can disregard state expertise and dilute the statutorily defined authority of states to design, implement and manage delegated environmental protection programs.

7. The current fiscal environment exacerbates tensions among states and federal agencies responsible for air quality regulation. States are required to expend limited resources to

manage regulatory programs over which their strategic control is sometimes undermined.

B. GOVERNORS' POLICY STATEMENT

1. **State Authority under the CAA:** As is the case with other federal environmental statutes, states have significant regulatory responsibility under the CAA and are tasked with developing implementation plans to accomplish CAA objectives. New EPA regulations, rulemaking, and guidance should recognize state authority under the CAA, as well as under other federal environmental statutes. Western Governors have specifically enumerated their state consultation objectives for federal agencies – including EPA -- in Western Governors' Association Policy Resolution 14-09: *Respecting State Authority and Expertise.*

Regarding the CAA, Western Governors state the following:

a) **Treatment of States as Co-Regulators**: In determining rules to pursue, and how to pursue them, EPA should take into account state views and opinions to a greater extent. Western Governors urge EPA to engage the states as co-regulators and to ensure that state agencies and representatives have a robust voice and meaningful role to play in the development of any EPA rule promulgated under the CAA, particularly in the early stages of rule development and before significant momentum precludes state participation or renders it non-meaningful.

b) **State Implementation Plans**: Despite statutorily required state implementation responsibility, the recent *Regional Haze Rulemaking*[1] demonstrates EPA's willingness to second guess state technical expertise and site-specific decisions, challenge state SIPs, and pursue takeover of state-implemented programs.[2] EPA should follow the provisions of the CAA and defer to states with respect to implementation of its existing and newly promulgated rules. Prior to any intervention in state programs, federal agencies – especially EPA – should consult in a meaningful way, and on a timely basis, with states.

c) **Early Action Credit**: In its review of SIPs, EPA should take into account and provide due credit for proactive actions taken by states to improve air quality and reduce emissions deemed detrimental to air quality. Early action credit

[1] "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations," 70 FR 39104 (6 September 2005), pp. 31513 - 31608.
[2] EPA claimed that the state plans it overturned were inadequate. Disagreeing with that assessment, Oklahoma, Wyoming, North Dakota and Arizona are all legally challenging EPA over the rule as of the date of this Resolution.

should recognize a full range of actions taken by states including, but not limited to, state-specific emissions reduction programs, renewable energy standards and objectives, and energy efficiency and conservation programs.

d) **State Flexibility to Determine Implementation Methods**: Western Governors believe states are best positioned to understand available technologies and methods for use in their SIPs. In reviewing SIPs for emission reduction or other air quality programs EPA should allow states the flexibility to integrate a variety of tools and compliance methods at their disposal. In this time of fiscal uncertainty, such flexibility would allow for creative and effective methods of emission reductions, while also allowing states to use and develop new means of meeting EPA requirements.

2. **Coordination of EPA Rulemaking Actions**: EPA should ensure that newly promulgated rules are drafted and issued, where appropriate, in coordination with existing regulations, taking into account elements and requirements common to both. Where new rules are related to regulations already in place, coordination among them would enable states to develop plans addressing the requirements of both rules, thereby saving time and money of the states while also ensuring that SIPs are developed in a manner to address multiple EPA rules.

3. **EPA Support and Technical Assistance**: EPA should provide states and local entities with adequate support and technical assistance to help them comply with regulations promulgated under the CAA. New requirements that impose additional burdens on states should be accompanied by adequate funding to enable states to implement the requirements.

4. **Prioritization of Rules**: EPA should collaborate with states to identify priority areas and focus on programs that provide the greatest benefit to air quality. This prioritization would allow states to focus on and devote necessary funding and staff resources to areas of the greatest concern.

5. **EPA Adherence to Schedule**: When engaged in the rulemaking process, EPA should adhere closely to the timelines in the CAA. Variation from these timelines results in undue strain being placed on state efforts to work with EPA, develop state responses to EPA rulemakings and determine appropriate tools to incorporate in SIPs.

C. <u>GOVERNORS' MANAGEMENT DIRECTIVE</u>

1. The Governors direct the WGA staff, where appropriate, to work with EPA, Congressional committees of jurisdiction, and the Executive Branch to achieve the

objectives of this resolution including funding, subject to the appropriation process, based on a prioritization of needs.

2. Additionally the Governors direct the WGA staff to develop, as appropriate and timely, detailed annual work plans to advance the policy positions and goals contained in this resolution. Those work plans shall be presented to, and approved by, Western Governors prior to implementation. WGA staff shall keep the Governors informed, on a regular basis, of their progress in implementing approved annual work plans.

WESTERN GOVERNORS' ASSOCIATION

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February 3, 2016

U.S. Environmental Protection Agency
EPA Docket Center
Docket No. EPA-HQ-OAR-2013-0572 and
Docket No. EPA-HQ-OAR-2015-0229
Mail Code 2821T
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Dear Ms. Palma:

The Western Governors' Association (WGA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA) proposed rule, Treatment of Data Influenced by Exceptional Events (the Exceptional Events Proposal), promulgated under section 319(b) of the Clean Air Act (CAA), and the related Draft Guidance on the Preparation of Exceptional Events Demonstrations for Wildfire Events that May Influence Ozone Concentrations (the Draft Guidance), both published November 20, 2015 (80 FR 72839).

STATEMENT OF INTEREST

WGA represents the Governors of 19 western states and 3 U.S.-flag islands. The association is an instrument of the Governors for bipartisan policy development, information exchange and collective action on issues of critical importance to the western United States.

Western Governors recognize the critical importance of maintaining air quality in our states and the western region and appreciate the opportunity to work with EPA to achieve this. As stated in WGA Policy Resolution 2014-13: State Clean Air Act Authority and Air Quality Regulation, Western Governors believe EPA should engage states as co-regulators and should ensure state agencies and representatives have a robust voice and play a meaningful role in any EPA rule promulgated under the CAA.

Western Governors previously expressed concern that the 2007 iteration of the Treatment of Data Influenced by Exceptional Events rule (the 2007 Exceptional Events Rule) did not adequately address factors impacting air quality over which states have little or no control. Western Governors also requested that substantive consultation, as described in WGA Policy Resolution: 2014-

09: Respecting State Authority and Expertise occur prior to publication of the Exceptional Events Proposal.[1]

Background of Western Governors' Position

Under section 319 of the CAA,[2] the term "exceptional event" refers to either a natural event or an event caused by human activity that is unlikely to recur at a particular location. Exceptional events can affect air quality but are not reasonably controllable or preventable by states. Section 319 of the CAA further states, "EPA may exclude air monitoring data influenced by exceptional events from use in making designations" provided states establish certain criteria.

The exceptional events rule is intended to ensure a state is not required to submit a State Implementation Plan (SIP) to address monitored air quality data from sources over which states have little or no control. The current exceptional events submission process is lengthy, inconsistent and ambiguous. As a result states, out of practical necessity, address exceptional events in a SIP. Given time and resources needed to create or modify a SIP, an efficient, consistent exceptional event submission process is vital.

Western Governors support EPA's effort to improve the exceptional events rule and submission process. A review of EPA's proposal shows that, while the agency has taken state concerns into account in certain circumstances, there are several additional steps the agency should take to ensure states' obligations are commensurate with regulatory authority delegated to states in the CAA.

EPA Change to "Clear Causal Relationship" Standard

The 2007 Exceptional Events Rule requires exceptional event submissions to establish that, "there would have been no exceedance or violation *but for* the event" (i.e., the "but for" standard).[3] It is extremely difficult to quantitatively establish that a particular exceptional event was the sole cause of a monitored National Ambient Air Quality Standard (NAAQS) exceedance.

Western Governors appreciate EPA's proposed shift to a "clear causal relationship" standard and removal of the "but for" test. This change will bring directives of the exceptional events

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[1] Prior related WGA communications are: March 17, 2015, comments to EPA on the proposed rule, National Ambient Air Quality (NAAQS) Standards for Ozone (79 FR 75233, December 17, 2014), and August 27, 2015, letter to EPA Administrator Gina McCarthy requesting substantive consultation with states on the then-expected revisions to the Treatment of Data Influenced by Exceptional Events rule.
[2] 42 U.S.C. § 7619 – Air Quality Monitoring.
[3] 40 C.F.R. 50.14(c)(3)(iv)(D).

rule within the statutory requirements of CAA section 319(b). It will enable states to establish a clear causal relationship between a monitored NAAQS exceedance and an exceptional event. This standard will allow for reliable and consistent reviews.

EPA Effort to Streamline State Submission Processes

Western Governors support EPA's effort to streamline the exceptional event submission process when circumstances surrounding an event are clear. EPA plans to codify certain fire-related definitions and exceptional event demonstration factors. While we raise some concerns in these comments, we hope EPA's effort will help with a common understanding of relevant terms.

Western Governors agree with EPA's proposed rebuttable presumption that every wildfire on wildland satisfies the "not reasonably controllable or preventable" criterion unless the record shows otherwise.[4] EPA's inclusion of this proposed directive in section 5 of the Draft Guidance will help address longstanding concerns about the extraordinary commitment of resources required in an exceptional event submission.

Role of Past Occurrences in Exceptional Event Submission

The Western States Air Resources Council (WESTAR) has previously expressed concern to EPA[5] about the agency's interpretation of the "not reasonably controllable or preventable" aspect of an exceptional event submission within the meaning of the 2007 Exceptional Events rule. It is WESTAR's position – and that of Western Governors – that EPA's past interpretation required a state to implement an undefined set of emission control or prevention measures in anticipation of uncontrollable events that may occur in the future.[6]

Section 319(b)(1)(A)(ii) of the CAA states an exceptional event, whether caused by natural phenomena or human activity, is one that is, "not reasonably controllable or preventable." EPA's past approach to the criterion, as described in section V(E)(2) of the proposal, has been:

- An exceptional event must be "not reasonably controllable." Under EPA's interpretation, this means if a set of measures to reduce the magnitude and impact of event-related emissions *should reasonably have been in place* for emission sources that contribute to emissions, then those controls *must* have been in place; and

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[4] Section V(F)(2)(c)(ii) of the Exceptional Events Proposal.
[5] *Public Hearing Testimony of Dan Johnson, Executive Director of WESTAR: Proposed Exceptional Events Revisions.* Testimony given before the Environmental Protection Agency. December 8, 2015.
[6] *Id.*

- An exceptional event must also be "not reasonably preventable." Under EPA's interpretation, this means if a set of measures to stop or avert the event *should reasonably have been in place* (for human activity-caused sources), then those measures *must* have been in place for the event.

The Exceptional Events Proposal retains this interpretation and section 5 of the Draft Guidance incorporates this approach. This interpretation, as a pre-condition for approval of an exceptional event request, requires states to demonstrate to EPA's satisfaction any state emission control or prevention measures that "reasonably" could have been in place at the time of the events were in place. This would require control measures in all areas that might experience dust events, wildfire events, or volcanic events.[7]

Natural emission sources in western states are often on federal land. Under EPA's interpretation states would be required to take undefined emission reduction steps to account for future events that are both uncontrollable and unpredictable, but that also may occur under federal managers.

This approach creates a potential disadvantage for western areas in attainment with current NAAQS that are home to expanses of federal land. It could require state implementation of proactive emission control or prevention measures prior to event occurrence and prior to a finding of NAAQS non-attainment.

States should not be held accountable for determining on a prospective basis:

- What control or prevention measures EPA or federal land managers (FLMs) would find "reasonable" under the exceptional events rule; or

- What unforeseen and uncontrollable NAAQS pollutant emitting events may occur in the future.

EPA should consider relevant control measures included in recent non-attainment or maintenance SIPs as sufficient to meet the "not reasonably controllable or preventable" criterion. This concept should apply in attainment areas as well.[8]

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[7] Section V(B)(1) of the Exceptional Events Proposal notes volcanoes are known to vent plumes of sulfur dioxide (SO_2) as well as particulate matter (both $PM_{2.5}$ and PM_{10}) precursors.
[8] *Id.*

Prescribed Fires, Wildfires and Deference to Fire Managers

State and local agencies are responsible for achieving or maintaining NAAQS attainment status. Consequently, Western Governors have concerns about substantive changes EPA proposes to address NAAQS impacts from wildfires. The changes could detrimentally affect state and local agencies by necessitating an exceptional event submission under the exceptional events rule. In particular, Western Governors are concerned about EPA's proposed deference to a land management agency representative conducting prescribed fires to declare a prescribed fire a wildfire because a unilateral FLM decision to prescribe a fire, and later declare it a wildfire, would necessitate action – or additional action – by a state.

The proposed rule's language regarding exceptional event submissions by FLMs exacerbates Western Governors' concern. The proposed rule requires the FLM's "discuss[ing] such submittal with the state" before submitting it to EPA. However, it does not require the FLM to integrate a state's concerns into its submittal to EPA. Therefore, a FLM's submittal to EPA could conflict with a state's position. We also recommend that western states with existing, comprehensive state air quality regulatory programs should have the option of being the lead entity, instead of the EPA, for the receipt of exceptional event submissions from FLMs or from state land or fire managers.

Finally, Western Governors seek to clarify in the proposed rule on the application of definitions of wildfire[9] and wildland[10] to areas of the wildland urban interface (WUI). Wildfire can begin in a wildland area and progress through the WUI into suburban areas. Also, air pollution emissions originating in a wildland area can have subregional effects beyond the wildland area or WUI. The proposed rule should clearly state that in those cases, the entire fire progression is a natural event for the purposes of an exceptional event submission.

SUMMARY

Western Governors appreciate those state concerns addressed in the Exceptional Events Proposal and Draft Guidance, including the "clear causal relationship" standard and EPA's effort to better streamline the state exceptional event submission process. WGA continues to be concerned by the retention of "not reasonably controllable or preventable" criterion (and its interpretation) and the deference accorded by EPA to FLMs and federal fire managers. While it is Western Governors' position that there is a vital need for a more active federal role in forest

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[9] EPA's proposal would also revise the definition of a "natural event" so that an event with a mix of non-anthropogenic emissions and reasonably controlled human-affected emission sources may be considered a natural event. Section V(D)(2) of the Exceptional Events Proposal.

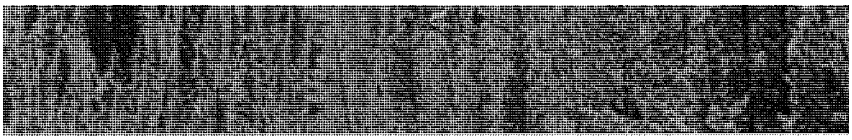
[10] *Id.* Section 1 of the Draft Guidance also incorporates relevant definitions, including the definition of "wildland" EPA plans to adopt.

management, that role must respect state authority and not create unnecessary burdens on state or local regulators. Western Governors ask EPA to address these concerns before finalizing the Exceptional Events Proposal and Draft Guidance and to engage western states as partners to identify workable solutions for all parties involved.

Sincerely,

Matthew H. Mead
Governor of Wyoming
Chairman, WGA

Steve Bullock
Governor of Montana
Vice Chair, WGA



Climate Change Impacts in the United States

CHAPTER 7
FORESTS

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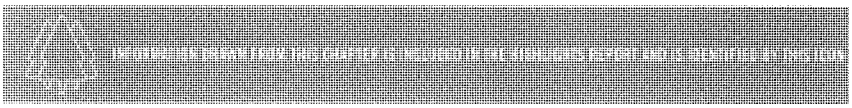


7 FORESTS

Key Messages

1. **Climate change is increasing the vulnerability of many forests to ecosystem changes and tree mortality through fire, insect infestations, drought, and disease outbreaks.**
2. **U.S. forests and associated wood products currently absorb and store the equivalent of about 16% of all carbon dioxide (CO_2) emitted by fossil fuel burning in the U.S. each year. Climate change, combined with current societal trends in land use and forest management, is projected to reduce this rate of forest CO_2 uptake.**
3. **Bioenergy could emerge as a new market for wood and could aid in the restoration of forests killed by drought, insects, and fire.**
4. **Forest management responses to climate change will be influenced by the changing nature of private forestland ownership, globalization of forestry markets, emerging markets for bioenergy, and U.S. climate change policy.**

Forests occur within urban areas, at the interface between urban and rural areas (wildland-urban interface), and in rural areas. Urban forests contribute to clean air, cooling buildings, aesthetics, and recreation in parks. Development in the wildland-urban interface is increasing because of the appeal of owning homes near or in the woods. In rural areas, market factors drive land uses among commercial forestry and land uses such as agriculture. Across this spectrum, forests provide recreational opportunities, cultural resources, and social values such as aesthetics.[1]

Economic factors have historically influenced both the overall area and use of private forestland. Private entities (such as corporations, family forest owners, and tribes) own 56% of the forestlands in the United States. The remaining 44% of forests are on public lands: federal (33%), state (9%), and county and municipal government (2%).[2] Market factors can influence management objectives for public lands, but societal values also influence objectives by identifying benefits such as environmental services not ordinarily provided through markets, like watershed protection and wildlife habitat. Different challenges and opportunities exist for public and for private forest management decisions, especially when climate-related issues are considered on a national scale. For example, public forests typically carry higher levels of forest biomass, are more remote, and tend not to be as intensively managed as private forestlands.[1]

Forests provide opportunities to reduce future climate change by capturing and storing carbon, as well as by providing resources for bioenergy production (the use of forest-derived plant-based materials for energy production). The total amount of carbon stored in U.S. forest ecosystems and wood products (such as lumber and pulpwood) equals roughly 25 years of U.S. heat-trapping gas emissions at current rates of emission, providing an important national "sink" that could grow or shrink depending on the extent of climate change, forest management practices, policy decisions, and other factors.[3,4] For example, in 2011, U.S. forest ecosystems and the associated wood products industry captured and stored roughly 16% of all carbon dioxide emitted by fossil fuel burning in the United States.[3]

Management choices for public, private, and tribal forests all involve similar issues. For example, increases in wildfire, disease, drought, and extreme events are projected for some regions (see also Ch. 16: Northeast; Ch. 20: Southwest; Ch. 21: Northwest, Key Message 3; and Ch. 22: Alaska). At the same time, there is growing awareness that forests may play an expanded role in carbon management. Urban expansion fragments forests and may limit forest management options. Addressing climate change effects on forestlands requires considering the interactions among land-use practices, energy options, and climate change.[5]

Key Message 1: Increasing Forest Disturbances

Climate change is increasing the vulnerability of many forests to ecosystem changes and tree mortality through fire, insect infestations, drought, and disease outbreaks.

Insect and pathogen outbreaks, invasive species, wildfires, and extreme events such as droughts, high winds, ice storms, hurricanes, and landslides induced by storms[8] are all disturbances that affect U.S. forests and their management (Figure 7.1). These disturbances are part of forest dynamics, are often interrelated, and can be amplified by underlying trends – for example, decades of rising average temperatures can increase damage to forests when a drought occurs.[9] Disturbances that affect large portions of forest ecosystems occur relatively infrequently and in response to climate extremes. Changes in climate in the absence of extreme climate events (and the forest disturbances they trigger) may result in increased forest productivity, but extreme climate events can potentially overturn such patterns.[10]

Factors affecting tree death – such as drought, physiological water stress, higher temperatures, and/or pests and pathogens – are often interrelated, which means that isolating a single cause of mortality is rare.[11,12,13] However, in western forests there have been recent large-scale die-off events due to one or more of these factors,[14,15,16] and rates of tree mortality are well correlated with both rising temperatures and associated increases in evaporative water demand.[17] In eastern forests, tree mortality at large spatial scales was more sensitive

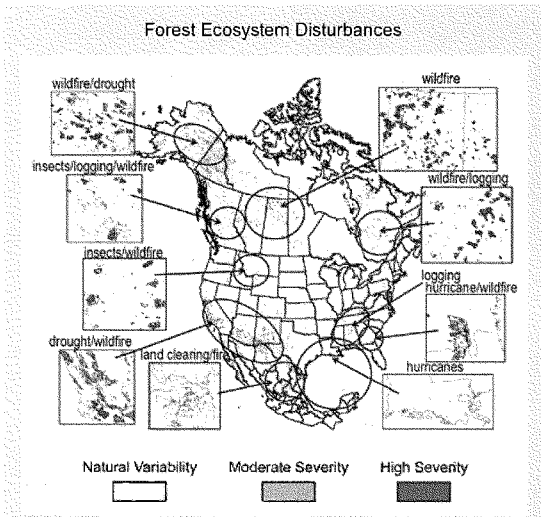
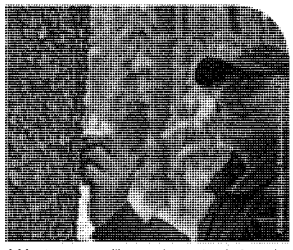
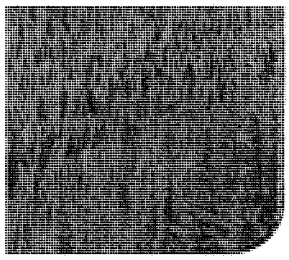


Figure 7.1. An example of the variability and distribution of major ecosystem disturbance types in North America, compiled from 2005 to 2009. Forest disturbance varies by topography, vegetation, weather patterns, climate gradients, and proximity to human settlement. Severity is mapped as a percent change in a satellite-derived Disturbance Index. White areas represent natural annual variability, orange represents moderate severity, and red represents high severity.[6] Fire dominates much of the western forest ecosystems, and storms affect the Gulf Coast. Insect damage is widespread but currently concentrated in western regions, and timber harvest is predominant in the Southeast. (Figure source: modified from Goetz et al. 2012;[7] Copyright 2012 American Geophysical Union).



A Montana saw mill owner inspects a lodgepole pine covered in pitch tubes that show the tree trying, unsuccessfully, to defend itself against the bark beetle. The bark beetle is killing lodgepole pines throughout the western U.S.



Warmer winters allow more insects to survive the cold season, and a longer summer allows some insects to complete two life cycles in a year instead of one. Drought stress reduces trees' ability to defend against boring insects. Above, beetle-killed trees in Rocky Mountain National Park in Colorado.

to forest structure (age, tree size, and species composition) and air pollutants than climate over recent decades. Nonetheless, mortality of some eastern tree groups is related to rising temperature[18] and is expected to increase as climate warms.[19]

Future disturbance rates in forests will depend on changes in the frequency of extreme events as well as the underlying changes in average climate conditions.[9,20] Of particular concern is the potential for increased forest disturbance as the result of drought accompanied with warmer temperatures, which can cause both wildfire and tree death. Temperatures have generally been increasing and are projected to increase in the future (see Ch. 2: Our Changing Climate). Therefore, although it is difficult to predict trends in future extreme events,[21] there is a high degree of confidence that future droughts will be accompanied by generally warmer conditions. Trees die faster when drought is accompanied by higher temperatures, so short droughts can trigger mortality if temperatures are higher.[22] Short droughts occur more frequently than long droughts. Consequently, a direct effect of rising temperatures may be substantially greater tree mortality even with no change in drought frequency.[22]

Given strong relationships between climate and fire, even when modified by land use and management, such as fuel treatments (Figure 7.2), projected climate changes suggest that western forests in the United States will be increasingly affected by large and intense fires that occur more frequently.[16,23,24,25] These impacts are compounded by a legacy of fire suppression that has resulted in many U.S. forests becoming increasingly dense.[26] Eastern forests are less likely to experience immediate increases in wildfire, unless a point is reached at which rising temperatures combine with seasonal dry periods, more protracted drought, and/or insect outbreaks to trigger wildfires – conditions that have been seen in Florida (see Ch. 17: Southeast).

Rising temperatures and CO_2 levels can increase growth or alter migration of some tree species;[1,27] however, the relationship between rising temperature and mortality is complex. For example, most functional groups show a decrease in mortality with higher summer temperatures (with the exception of northern groups), whereas warmer winters are correlated with higher mortality for some functional groups.[18] Tree mortality is often the result of a combination of many factors; thus increases in pollutants, droughts, and wildfires will increase the probability of a tree dying (Figure 7.3). Under projected climate conditions, rising temperatures could work together with forest stand characteristics and these other stressors to increase mortality. Recent die-offs have been more severe than projected.[11,14] As temperatures increase to levels projected for mid-century and beyond, eastern forests may be at risk of die-off.[19] New evidence indicates that most tree species can endure only limited abnormal water stress, reinforcing the idea that trees in wetter as well as semiarid forests are vulnerable to drought-induced mortality under warming climates.[28]

Effectiveness of Forest Management in Reducing Wildfire Risk

Figure 7.2. Forest management that selectively removes trees to reduce fire risk, among other objectives (a practice referred to as "fuel treatments"), can maintain uneven-aged forest structure and create small openings in the forest. Under some conditions, this practice can help prevent large wildfires from spreading. Photo shows the effectiveness of fuel treatments in Arizona's 2002 Rodeo-Chediski fire, which burned more than 400 square miles – at the time the worst fire in state history. Unburned areas (left) had been managed with a treatment that removed commercial timber, thinned non-commercial-sized trees, and followed with prescribed fire in 1999. The right side of the photo shows burned area on the untreated slope below Limestone Ridge. (Photo credit: Jim Youtz, U.S. Forest Service)

Climate change is contributing to increases in wildfires across the western U.S. and Alaska.

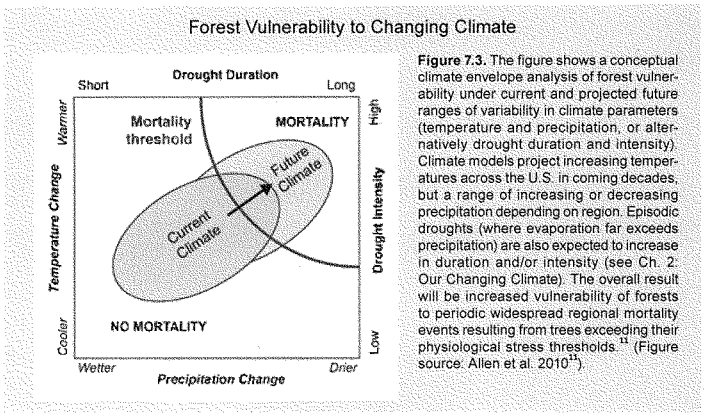


Figure 7.3. The figure shows a conceptual climate envelope analysis of forest vulnerability under current and projected future ranges of variability in climate parameters (temperature and precipitation, or alternatively drought duration and intensity). Climate models project increasing temperatures across the U.S. in coming decades, but a range of increasing or decreasing precipitation depending on region. Episodic droughts (where evaporation far exceeds precipitation) are also expected to increase in duration and/or intensity (see Ch. 2: Our Changing Climate). The overall result will be increased vulnerability of forests to periodic widespread regional mortality events resulting from trees exceeding their physiological stress thresholds.[11] (Figure source: Allen et al. 2010[11]).

Large-scale die-off and wildfire disturbance events could have potential impacts occurring at local and regional scales for timber production, flooding and erosion risks, other changes in water budgets, biogeochemical changes including carbon storage, and aesthetics.[29,30,31] Rising disturbance rates can increase harvested wood output and potentially lower prices; however, higher disturbance rates could make future forest investments more risky (Figure 7.4). Western forests could also lose substantial amounts of carbon storage capacity. For example, an increase in wildfires, insect outbreaks, and droughts that are severe enough to alter soil moisture and nutrient contents can result in changes in tree density or species composition.[10]

Key Message 2: Changing Carbon Uptake

U.S. forests and associated wood products currently absorb and store the equivalent of about 16% of all carbon dioxide (CO_2) emitted by fossil fuel burning in the U.S. each year. Climate change, combined with current societal trends in land use and forest management, is projected to reduce this rate of forest CO_2 uptake.

Climate-related Effects on Trees and Forest Productivity

Forests within the United States grow across a wide range of latitudes and altitudes and occupy all but the driest regions. Current forest cover has been shaped by climate, soils, topography, disturbance frequency, and human activity. Forest growth appears to be slowly accelerating (less than 1% per decade) in regions where tree growth is limited by low temperatures and short growing seasons that are gradually being altered by climate change (for species shifts, see Ch. 8: Ecosystems).[32] Forest carbon storage appears to be increasing both globally and within the United States.[33] Continental-scale satellite measurements document a lengthening growing season in the last thirty years, yet earlier spring growth may be negated by mid-summer drought.[34]

By the end of the century, snowmelt may occur a month earlier, but forest drought stress could increase by two months in the Rocky Mountain forests.[35] In the eastern United States, elevated CO_2 and temperature may increase forest growth and potentially carbon storage if sufficient water is available.[1,31,36] Despite recent increases in forest growth, future net forest carbon storage is expected to decline due to accelerating mortality and disturbance.

Forests can be a Source – or a Sink – for Carbon

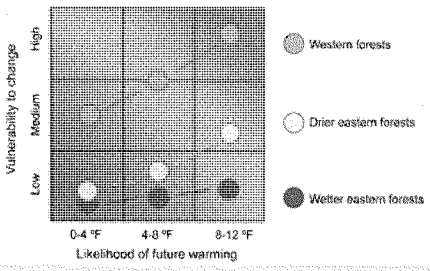


Figure 7.4. Relative vulnerability of different forest regions to climate change is illustrated in this conceptual risk analysis diagram. Forest carbon exchange is the difference between carbon captured in photosynthesis and carbon released by respiration of vegetation and soils. Both photosynthesis and respiration are generally accelerated by higher temperatures, and slowed by water deficits, but the relative strengths of these controls are highly variable. Western forests are inherently limited by evaporation that exceeds precipitation during much of the growing season. Xeric (drier) eastern forests grow on shallow, coarse textured soils and experience water deficits during long periods without rain. Mesic (wetter) eastern forests experience severe water deficits only for relatively brief periods in abnormally dry years so the carbon exchanges are more controlled by temperature fluctuations. (Figure source: adapted from Vose et al. 2012[1]).

Forest Carbon Sequestration and Carbon Management

From the onset of European settlement to the start of the last century, changes in U.S. forest cover due to expansion of agriculture, tree harvests, and settlements resulted in net emissions of carbon.[37,38] More recently, with forests reoccupying land previously used for agriculture, technological advances in harvesting, and changes in forest management, U.S. forests and associated wood products now serve as a substantial carbon sink, capturing and storing more than 227.6 million tons of carbon per year.[3] The amount of carbon taken up by U.S. land is dominated by forests (Figure 7.5), which have annually absorbed 7% to 24% of fossil fuel carbon dioxide (CO_2) emissions in the U.S. over the past two decades. The best estimate is that forests and wood products stored about 16% (833 teragrams, or 918.2 million short tons, of CO_2 equivalent in 2011) of all the CO_2 emitted annually by fossil fuel burning in the United States (see also "Estimating the U.S. Carbon Sink" in Ch. 15: Biogeochemical Cycles).[3]

Forest Growth Provides an Important Carbon Sink

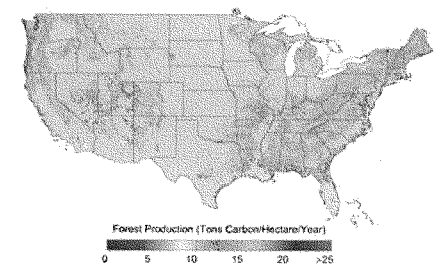


Figure 7.5. Forests are the largest component of the U.S. carbon sink, but growth rates of forests vary widely across the country. Well-watered forests of the Pacific Coast and Southeast absorb considerably more than the arid southwestern forests or the colder northeastern forests. Climate change and disturbance rates, combined with current societal trends regarding land use and forest management, are projected to reduce forest CO_2 uptake in the coming decades.[1] Figure shows average forest growth as measured by net primary production from 2000 to 2006. (Figure source: adapted from Running et al. 2004[46]).

The future role of U.S. forests in the carbon cycle will be affected by climate change through changes in disturbances (see Figures 7.3 and 7.4), as well as shifts in tree species, ranges, and productivity (Figure 7.6).[19,38] Economic factors will affect any future carbon cycle of forests, as the age class and condition of forests are affected by the acceleration of harvesting,[39,40] land-use changes such as urbanization,[41] changes in forest types,[42] and bioenergy development.[41,43,44,45]

Efforts in forestry to reduce atmospheric CO_2 levels have focused on forest management and forest product use. Forest management strategies include land-use change to increase forest area (afforestation) and/or to avoid deforestation and optimizing carbon management in existing forests. Forest product-use strategies include the use of wood wherever possible as a structural substitute for steel and concrete, which require more carbon emissions to produce.[38] The carbon emissions offset from using wood rather than alternate materials for a range of applications can be two or more times the carbon content of the product.[47]

In the U.S., afforestation (active establishment or planting of forests) has the potential to capture and store a maximum of 225 million tons of additional carbon per year from 2010 to 2110[39,48] (an amount almost equivalent to the current annual carbon storage in forests). Tree and shrub encroachment into grasslands, rangelands, and savannas provides a large potential carbon sink that could exceed half of what existing U.S. forests capture and store annually.[48]

Expansion of urban and suburban areas is responsible for much of the current and expected loss of U.S. forestland, although these human-dominated areas often have extensive tree cover and potential carbon storage (see also Ch. 13: Land Use & Land Cover Change).[41] In addition, the increasing prevalence of extreme conditions that encourage wildfires can convert some forests to shrublands and meadows[25] or permanently reduce the amount of carbon stored in existing forests if fires occur more frequently.[49]

Carbon management on existing forests can include practices that increase forest growth, such as fertilization, irrigation, switching to fast-growing planting stock, shorter rotations, and weed, disease, and insect control.[50] In addition, forest management can increase average forest carbon stocks by increasing the interval between harvests, by decreasing harvest intensity, or by focused density/species management.[4,51] Since 1990, CO_2 emissions from wildland forest fires in the lower 48 United States have averaged about 67 million tons of carbon per year.[52,53] While forest management practices can reduce on-site carbon stocks, they may also help reduce future climate change by providing feedstock material for bioenergy production and by possibly avoiding future, potentially larger, wildfire emissions through fuel treatments (Figure 7.2).[1]

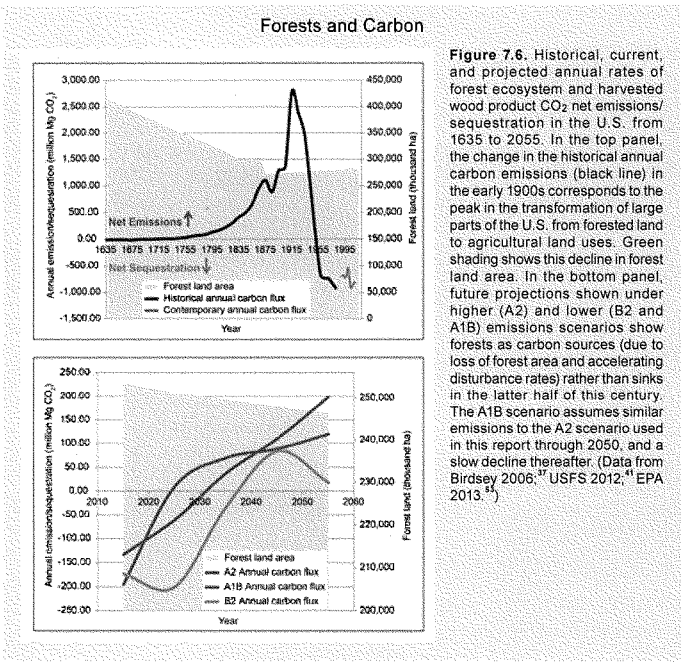


Figure 7.6. Historical, current, and projected annual rates of forest ecosystem and harvested wood product CO_2 net emissions/sequestration in the U.S. from 1635 to 2055. In the top panel, the change in the historical annual carbon emissions (black line) in the early 1900s corresponds to the peak in the transformation of large parts of the U.S. from forested land to agricultural land uses. Green shading shows this decline in forest land area. In the bottom panel, future projections shown under higher (A2) and lower (B2 and A1B) emissions scenarios show forests as carbon sources (due to loss of forest area and accelerating disturbance rates) rather than sinks in the latter half of this century. The A1B scenario assumes similar emissions to the A2 scenario used in this report through 2050, and a slow decline thereafter. (Data from Birdsey 2006;[37] USFS 2012;[41] EPA 2013.[33])

Key Message 3: Bioenergy Potential

Bioenergy could emerge as a new market for wood and could aid in the restoration of forests killed by drought, insects, and fire.

Bioenergy refers to the use of plant-based material to produce energy, and comprises about 28% of the U.S. renewable energy supply (Ch. 10: Energy, Water, and Land). Forest resources potentially could produce bioenergy from 504 million acres of timberland and 91 million acres of other forested land (Figure 7.7). Bioenergy from all sources, including agricultural and forests, could theoretically supply the equivalent of up to 30% of current U.S. petroleum consumption, but only if all relevant policies were optimized.[45] The *maximum* projected potential for forest bioenergy ranges from 3% to 5% of total current U.S. energy consumption.[54]

Forest biomass energy could be one component of an overall bioenergy strategy to reduce emissions of carbon from fossil fuels,[55] while also improving water quality[56,57] and maintaining lands for timber production as an alternative to other socioeconomic options. Active biomass energy markets using wood and forest residues have emerged in the southern and northeastern United States, particularly in states that have adopted renewable fuel standards. The economic viability of using forests for bioenergy depends on regional context and circumstances, such as species type and prior management, land conditions, transport and storage logistics, conversion processes used to produce energy, distribution, and use.[58] The environmental and socioeconomic consequences of bioenergy production vary greatly with region and intensity of human management.

The potential for biomass energy to increase timber harvests has led to debates about whether forest biomass energy leads to higher carbon emissions.[44,59] The debate on biogenic emissions regulations revolves around how to account for emissions related to biomass production and use.[60] The forest carbon balance naturally changes over time and also depends on forest management scenarios. For example, utilizing natural beetle-killed forests will yield a different carbon balance than growing and harvesting a live, fast-growing plantation.

Markets for energy from biomass appear to be ready to grow in response to energy pricing, policy, and demand,[44] although recent increases in the supply of natural gas have reduced the perceived urgency for new biomass projects. Further, because energy facilities typically buy the lowest quality wood at prices that rarely pay much more than cutting and hauling costs, they often require a viable saw timber market nearby to ensure an adequate, low-cost supply of material.[61] Where it is desirable to remove dead wood after disturbances to thin forests or to dispose of residues, a viable bioenergy industry could finance such activities. However, the bioenergy market has yet to be made a profitable enterprise in most U.S. regions.

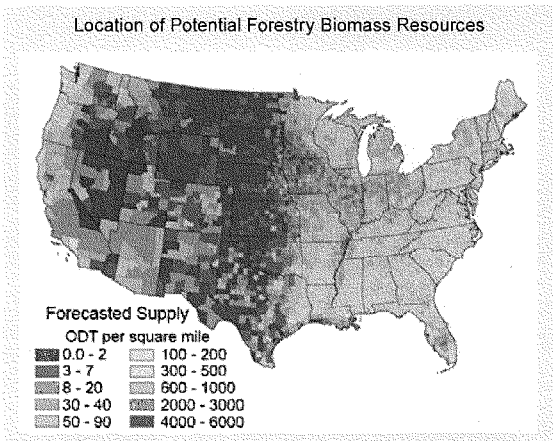


Figure 7.7. Potential forestry bioenergy resources by 2030 at $80 per dry ton of biomass based on current forest area, production rates based on aggressive management for fast-growth, and short rotation bioenergy plantations. Units are oven dry tons (ODT) per square mile at the county level, where an ODT is 2,000 pounds of biomass from which the moisture has been removed. Includes extensive material from existing forestland, such as residues, simulated thinnings, and some pulpwood for bioenergy, among other sources. (Figure source: adapted from U.S. Department of Energy 2011[45]).

Key Message 4: Influences on Management Choices

Forest management responses to climate change will be influenced by the changing nature of private forestland ownership, globalization of forestry markets, emerging markets for bioenergy, and U.S. climate change policy.

Climate change will affect trees and forests in urban areas, the wildland-urban interface, and in rural areas. It will also challenge forest landowners managing forests for commercial products, energy development, environmental services such as watershed protection, or the conversion of forestland to developed and urban uses or agriculture. With increases in urbanization, the value of forests in and around urban areas in providing environmental services required by urban residents will increase.[41] Potentially the greatest shifts in goods and environmental services produced from forests could occur in rural areas where social and economic factors will interact with the effects of climate change at landscape scales.

Owner objectives, markets for forest products, crops and energy, the monetary value of private land, and policies governing private and public forestland all influence the actions taken to manage U.S. forestlands (56% privately owned, 44% public) (Figure 7.8). Ownership changes can bring changes in forest objectives. Among corporate owners (18% of all forestland), ownership has shifted from forest industry to investment management organizations that may or may not have active forest management as a primary objective. Non-corporate private owners, an aging demographic, manage 38% of forestland. Their primary objectives are maintaining aesthetics and the privacy that the land provides as well as preserving the land as part of their family legacy.[62]

A significant economic factor facing private forest owners is the value of their forestlands for conversion to urban or developed uses. Economic opportunities from forests include wood products, non-timber forest products, recreation activities, and in some cases, environmental services.[1,41] Less than 1% of the volume of commercial trees from U.S. forestlands is harvested annually, and 92% of this harvest comes from private forestlands.[2] Markets for wood products in the United States have been affected by increasingly competitive global markets,[63] and timber prices are not projected to increase without substantial increases in wood energy consumption or other new timber demands.[41] Urban conversions of forestland over the next 50 years could result in the loss of 16 to 31 million acres.[41] The willingness of private forest owners to actively manage forests in the face of climate change will be affected primarily by market and policy incentives, not climate change itself.

The ability of public, private, and tribal forest managers to adapt to future climate change will be enhanced by their capacity to alter management regimes relatively rapidly in the face of changing conditions. The response to climate change may be greater on private forestlands where, in the past, owners have been highly responsive to market and policy signals.[64] These landowners may be able to use existing or current forest management practices to reduce disturbance effects, increase the capture and storage of carbon, and modify plant species distributions under climate change. In addition, policy incentives, such as carbon pricing or cap and trade markets, could influence landowner choices. For human communities dependent upon forest resources, maintaining or enhancing their current resilience to change will influence their ability to respond to future stresses from climate change.[65]

On public, private, and tribal lands, management practices that can be used to reduce disturbance effects include altering tree planting and harvest strategies through species selection and timing; factoring in genetic variation; managing for reduced stand densities, which could reduce wildfire risk; reducing other stressors such as poor air quality; using forest management practices to minimize drought stress; and developing regional networks to mitigate impacts on ecosystem goods and services.[1,30,66] Legally binding regulatory requirements may constrain adaptive management where plants, animals, ecosystems, and people are responding to climate change.[67]

Lack of fine-scale information about the possible effects of climate changes on locally managed forests limits the ability of managers to weigh these risks to their forests against the economic risks of implementing forest management practices such as adaptation and/or mitigation treatments. This knowledge gap will impede the implementation of effective management on public or private forestland in the face of climate change.

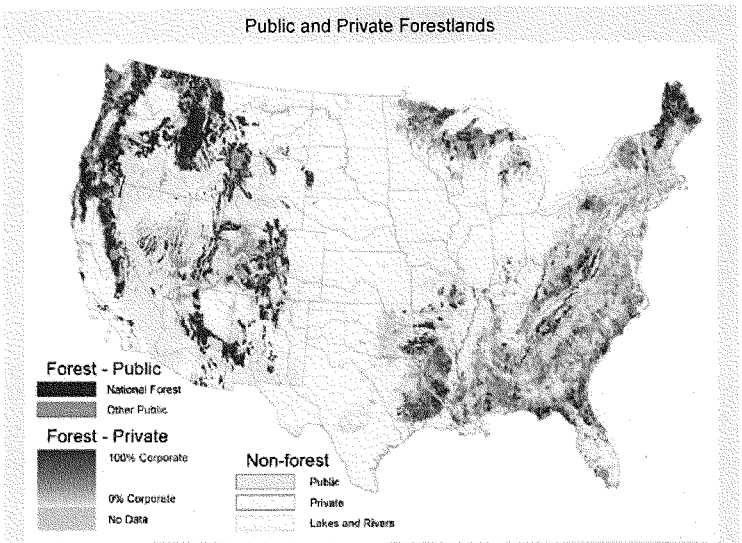


Figure 7.8. The figure shows forestland by ownership category in the contiguous U.S. in 2007.[41] Western forests are most often located on public lands, while eastern forests, especially in Maine and in the Southeast, are more often privately held. (Figure source: U.S. Forest Service 2012[41]).

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SUPPLEMENTAL MATERIAL

TRACEABLE ACCOUNTS

Process for Developing Key Messages:

A central component of the process was a workshop held in July 2011 by the U.S. Department of Agriculture Forest Service to guide the development of the technical input report (TIR). This session, along with numerous teleconferences, led to the foundational TIR, "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector."[1]

The chapter authors engaged in multiple technical discussions via teleconference between January and June 2012, which included careful review of the foundational TIR and of 58 additional technical inputs provided by the public, as well as other published literature and professional judgment. Discussions were followed by expert deliberation of draft key messages by the authors and targeted consultation with additional experts by the lead author of each message.

Key message #1 Traceable Account

Climate change is increasing the vulnerability of many forests to ecosystem changes and tree mortality through fire, insect infestations, drought, and disease outbreaks.

Description of evidence base

The key message and supporting text summarizes extensive evidence documented in the TIR, "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector."[1] Technical input reports (58) on a wide range of topics were also received and reviewed as part of the Federal Register Notice solicitation for public input.

Dale et al.[8] addressed a number of climate change factors that will affect U.S. forests and how they are managed. This is supported by additional publications focused on effects of drought and by more large-scale tree die-off events,[11,22] wildfire,[16,23,25] insects and pathogens.[11,22] Other studies support the negative impact of climate change by examining the tree mortality rate due to rising temperatures,[9,11,14,15,16,17,19,22] which is projected to increase in some regions.[22]

Although it is difficult to detect a trend in disturbances because they are inherently infrequent and it is impossible to attribute an individual disturbance event to changing climate, there is nonetheless much that past events, including recent ones, reveal about expected forest changes due to future climate. Observational[17] and experimental[22] studies show strong associations between forest disturbance and extreme climatic events and/or modifications in atmospheric evaporative demand related to warmer temperature. Regarding eastern forests, there are fewer observational or experimental studies, with Dietz and Moorcroft[18] being the most comprehensive.

Pollution and stand age are the most important factors in mortality. Tree survival increases with increased temperature in some groups. However, for other tree groups survival decreases with increased temperature.[18] In addition, this study[18] needs to be considered in the context that there have been fewer severe droughts in this region. However, physiological relationships suggest that trees will generally be more susceptible to mortality under an extreme drought, especially if it is accompanied by warmer temperatures.[13,68] Consequently, it is misleading to assume that, because eastern forests have not yet experienced the types of large-scale die-off seen in the western forests, they are not vulnerable to such events if an extreme enough drought occurs. Although the effect of temperature on the rate of mortality during drought has only been shown for one species,[22] the basic physiological relationships for trees suggest that warmer temperatures will exacerbate mortality for other species as well.[13,68]

Figure 7.1: This figure uses a figure from Goetz et al. 2012[7] which uses the MODIS Global Disturbance Index (MGDI) results from 2005 to 2009 to illustrate the geographic distribution of major ecosystem disturbance types across North America (based on Mildrexler et al. 2007, 2009[6,69]). The MGDI uses remotely sensed information to assess the intensity of the disturbance. Following the occurrence of a major disturbance, there will be a reduction in Enhanced Vegetation Index (EVI) because of vegetation damage; in contrast, Land Surface Temperature (LST) will increase because more absorbed solar radiation will be converted into sensible heat as a result of the reduction in evapotranspiration from less vegetation density. MGDI takes advantage of the contrast changes in EVI and LST following a disturbance to enhance the signal to ef-

fectively detect the location and intensity of disturbances (http://www.ntsg.umt.edu/project/mgdi). Moderate severity disturbance is mapped in orange and represents a 65%-100% divergence of the current-year MODIS Global Disturbance Index value from the range of natural variability, High severity disturbance (in red) signals a divergence of over 100%.[7]

New information and remaining uncertainties

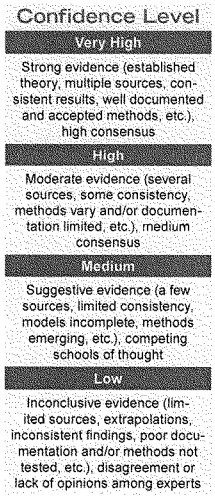
Forest disturbances have large ecosystem effects, but high interannual variability in regional fire and insect activity makes detection of trends more difficult than for changes in mean conditions.[20,21,70] Therefore, there is generally less confidence in assessment of future projections of disturbance events than for mean conditions (for example, growth under slightly warmer conditions).[21]

There are insufficient data on trends in windthrow, ice storms, hurricanes, and landslide-inducing storms to infer that these types of disturbance events are changing.

Factors affecting tree death, such as drought, warmer temperatures, and/or pests and pathogens are often interrelated, which means that isolating a single cause of mortality is rare.[11,12,13,17,22,68]

Assessment of confidence based on evidence

Very High. There is very high confidence that under projected climate changes there is high risk (high risk = high probability and high consequence) that western forests in the United States will be affected increasingly by large and intense fires that occur more frequently.[16,23,25] This is based on the strong relationships between climate and forest response, shown observationally[17] and experimentally.[22] Expected responses will increase substantially to warming and also in conjunction with other changes such as an increase in the frequency and/or severity of drought and amplification of pest and pathogen impacts. Eastern forests are less likely to experience immediate increases in wildfire unless/until a point is reached at which warmer temperatures, concurrent with seasonal dry periods or more protracted drought, trigger wildfires.



KEY MESSAGE #2 TRACEABLE ACCOUNT

U.S. forests and associated wood products currently absorb and store the equivalent of about 16% of all carbon dioxide (CO_2) emitted by fossil fuel burning in the U.S. each year. Climate change, combined with current societal trends in land use and forest management, is projected to reduce this rate of forest CO_2 uptake.

Description of evidence base

The key message and supporting text summarizes extensive evidence documented in the TIR, "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector."[1] Technical input reports (58) on a wide range of topics were also received and reviewed as part of the Federal Register Notice solicitation for public input.

A recent study[3] has shown that forests are a big sink of CO_2 nationally. However, the permanence of this carbon sink is contingent on forest disturbance rates, which are changing, and on economic conditions that may accelerate harvest of forest biomass.[56] Market response can cause changes in the carbon source/sink dynamics through shifts in forest age,[39,40] land-use changes and urbanization that reduce forested areas,[41] forest type changes,[42] and bioenergy development changing forest management.[41,43,44,45] Additionally, publications have reported that fires can convert a forest into a shrubland or meadow,[25] with frequent fires permanently reducing the carbon stock.[49]

New information and remaining uncertainties

That economic factors and societal choices will affect future carbon cycle of forests is known with certainty; the major uncertainties come from the future economic picture, accelerating disturbance rates, and societal responses to those dynamics.

Assessment of confidence based on evidence

Based on the evidence and uncertainties, confidence is **high** that climate change, combined with current societal trends regarding land use and forest management, is projected to reduce forest CO_2 uptake in the U.S. The U.S. has already seen large-scale shifts in forest cover due to interactions between forestland use and agriculture (for example, between the onset of European settlement to the present). There are competing demands for how forestland is used today. The future role of U.S. forests in the

carbon cycle will be affected by climate change through changes in disturbances (Key Message 1), growth rates, and harvest demands.

KEY MESSAGE #3 TRACEABLE ACCOUNT

Bioenergy could emerge as a new market for wood and could aid in the restoration of forests killed by drought, insects, and fire.

Description of evidence base

The key message and supporting text summarize extensive evidence documented in the TIR, "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector."[1] Technical input reports (58) on a wide range of topics were also received and reviewed as part of the Federal Register Notice solicitation for public input.

Studies have shown that harvesting forest bioenergy can prevent carbon emissions[55] and replace a portion of U.S. energy consumption to help reduce future climate change. Some newer literature has explored how use of forest bioenergy can replace a portion of current U.S. energy production from oil.[20,45] Some more recent publications have reported some environmental benefits, such as improved water quality[56,57] and better management of timber lands,[45] that can result from forest bioenergy implementation.

New information and remaining uncertainties

The implications of forest product use for bioenergy depends on regional context and circumstances, such as feedstock type and prior management, land conditions, transport and storage logistics, conversion processes used to produce energy, distribution and use.[58]

The potential for biomass energy to increase forest harvests has led to debates about whether biomass energy is net carbon neutral.[59] The debate on biogenic emissions regulations revolves around how to account for emissions related to biomass production and use.[60] Deforestation contributes to atmospheric CO_2 concentration, and that contribution has been declining over time. The bioenergy contribution question is largely one of incentives for appropriate management. When forests have no value, they are burned or used inappropriately. Bioenergy can be produced in a way that provides more benefits than costs or vice versa. The market for energy from biomass appears to be ready to grow in response to energy pricing, policy, and demand; however, this industry is yet to be made a large-scale profitable enterprise in most regions of the United States.

Assessment of confidence based on evidence

High. Forest growth substantially exceeds annual harvest for normal wood and paper products, and much forest harvest residue is now unutilized. Forest bioenergy will become viable if policy and economic energy valuations make it competitive with fossil fuels.

KEY MESSAGE #4 TRACEABLE ACCOUNT

Forest management responses to climate change will be influenced by the changing nature of private forestland ownership, globalization of forestry markets, emerging markets for bioenergy, and U.S. climate change policy.

Description of evidence base

The key message and supporting text summarizes extensive evidence documented in the TIR, "Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector."[1] Technical input reports (58) on a wide range of topics were also received and reviewed as part of the Federal Register Notice solicitation for public input.

The forest management response to climate change in urban areas, the wildland-urban interface, and in rural areas has been studied from varying angles. The literature on urban forests identifies the value of those forests to clean air, aesthetics, and recreation and suggests that under a changing climate, urban communities will continue to enhance their environment with trees and urban forests.[1,41] In the wildland-urban area and the rural areas, the changing composition of private forest landowners will affect the forest management response to climate change. Shifts in corporate owners to include investment organizations that may or may not have forest management as a primary objective has been described nationally.[1,2] Family forest owners are an aging demographic; one in five acres of forestland is owned by someone who is at least 75 years of age.[62] Multiple reasons for ownership are given by family forest owners, including the most commonly cited reasons of beauty/scenery, to pass land on to heirs, privacy, nature protection, and part of home/cabin. Many family forest owners feel it is necessary to keep the woods healthy but many are not familiar with forest management practices.[62] Long-term studies of the forest sector in the southern United States document the adaptive response of forest landowners to market prices as they manage to supply wood and associated products from their forests;[64] however prices are less of an incentive in other parts of the United States.[1,41] Econometric approaches have been used to explore the economic activities in the forest sector, including interactions with other sectors such as agriculture, impact of climate change, and the potential for new markets with bioenergy.[43,44] An earlier study explored the effects of globalization on forest management[63] and a newer study looked at the effect of U.S. climate change policy.[67] One of the biggest challenges is the lack of climate change information that results in inaction from many forest owners.[62]

New information and remaining uncertainties

Human concerns regarding the effects of climate change on forests and the role of adaptation and mitigation will be viewed from the perspective of the values that forests provide to human populations, including timber products, water, recreation, and aesthetic and spiritual benefits.[1] Many people, organizations, in-

stitutions, and governments influence the management of U.S. forests. Economic opportunities influence the amount and nature of private forestland (and much is known quantitatively about this dynamic) and societal values have a strong influence on how public forestland is managed. However, it remains challenging to project exactly how humans will respond to climate change in terms of forest management.

Climate change will alter known environmental and economic risks and add new risks to be addressed in the management of forests in urban areas, the wildland-urban interface, and rural areas. The capacity to manage risk varies greatly across landowners. While adaptation strategies provide a means to manage risks associated with climate change, a better understanding of risk perception by forest landowners would enhance the development and implementation of these management strategies. Identification of appropriate monitoring information and associated tools to evaluate monitoring data could facilitate risk assessment. Information and tools to assess environmental and economic risks associated with the impacts of climate change in light of specific management decisions would be informative to forestland managers and owners.

Assessment of confidence based on evidence

Given the evidence base and remaining uncertainty, there is **medium** confidence in this key message. Climate change and global and national economic events will have an integral impact on forest management, but it is uncertain to what magnitude. While forest landowners have shown the capacity to adapt to new economic conditions, potential changes in the international markets coincident with large-scale natural disturbances enhanced by climate change (fire, insects) could challenge this adaptive capacity. An important uncertainty is how people will respond to climate change in terms of forest management.

Wildfires

This indicator tracks the frequency, extent, and severity of wildfires in the United States.

Background

Together, forests, shrubland, and grassland cover more than half of the land area in the United States.[1] These ecosystems are important resources, both environmentally and economically. Although wildfires occur naturally and play a long-term role in the health of these ecosystems, climate change threatens to increase the frequency, extent, and severity of fires through increased temperatures and drought (see the U.S. and Global Temperature and Drought indicators). Earlier spring melting and reduced snowpack (see the Snowpack indicator) result in decreased water availability during hot summer conditions, which in turn contributes to an increased wildfire risk, allowing fires to start more easily and burn hotter. An increase in the length of the fire season has been observed in some areas.[2] In addition to climate change, other factors—like the spread of insects, land use, fuel availability, and management practices, including fire suppression—play an important role in wildfire frequency and intensity. All of these factors influencing wildfires vary greatly by region and over time, as do variations in precipitation, wind, temperature, vegetation types, and landscape conditions. Therefore, understanding changes in fire characteristics requires long-term records, a regional perspective, and consideration of many factors.[3]

Wildfires have the potential to harm property, livelihoods, and human health, particularly as population centers expand into wild land areas. The recreation and timber industries depend on healthy forests, and wildfire smoke has been directly linked to poor air quality and illness, even in communities far downwind.[4,5] Fire-related threats are increasing, especially as more people live in and around forests, grasslands, and other natural areas.[6] The United States spends more than $1 billion every year to fight wildfires and spent more than $2 billion in 2015.[7] These efforts have resulted in the deaths of hundreds of firefighters since 1910.[8]

Beyond the human impact, wildfires also affect the Earth's climate. Forests in particular store large amounts of carbon. When they burn, they release carbon dioxide into the atmosphere, which in turn contributes to climate change.

About the Indicator

This indicator defines wildfires as "unplanned, unwanted wildland fire[s]" in forests, shrubland, and grassland, where "the objective is to put the fire out."[9] This indicator tracks three aspects of wildfires over time: the total number of fires (frequency), the total land area burned (extent), and the degree of damage that fires cause to the landscape (severity). The total area and total number of fires are tracked by the National Interagency Fire Center, which compiles reports from local, state, and federal agencies that are involved in fighting wildfires. The U.S. Forest Service tracked similar data using a different reporting system until 1997. Those data have been added to this indicator for comparison. Wildfire severity is measured by comparing the "greenness" of satellite images taken before and after a fire to

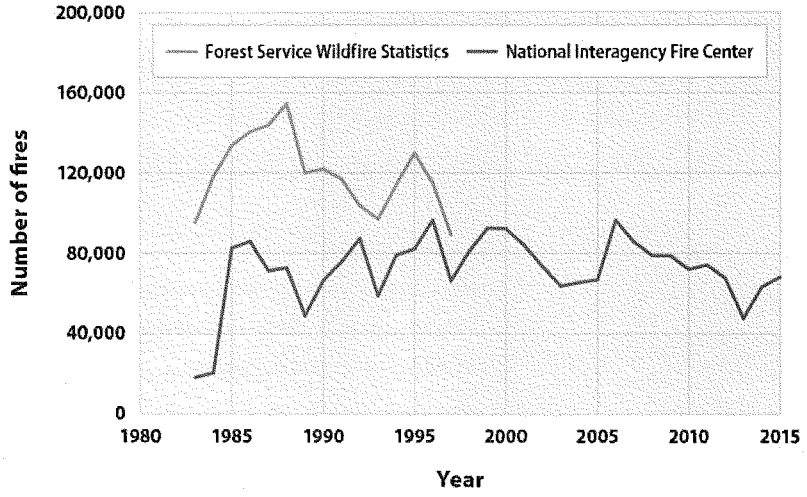
classify how severely the land has been burned. Burn severity provides an indication of the ecological damage and how long the effects of wildfires are likely to last.

Although some nationwide fire data have been collected since the early 1900s, this indicator starts in 1983 (Figures 1 and 2) and 1984 (Figures 3, 4, and 5), when nationwide data collection became more complete and standardized.

Key Points

- Since 1983, the National Interagency Fire Center has documented an average of 72,000 wildfires per year (see Figure 1). Compiled data from the Forest Service suggest that the actual total may be even higher for the first few years of nationwide data collection that can be compared. The data do not show an obvious trend during this time.
- The extent of area burned by wildfires each year appears to have increased since the 1980s. According to National Interagency Fire Center data, of the 10 years with the largest acreage burned, nine have occurred since 2000, including the peak year in 2015 (see Figure 2). This period coincides with many of the warmest years on record nationwide (see the U.S. and Global Temperature indicator).
- The late 1990s were a period of transition in certain climate cycles that tend to shift every few decades.[10] This shift—combined with other ongoing changes in temperature, drought, and snowmelt—may have contributed to warmer, drier conditions that have fueled wildfires in parts of the western United States.[11,12]
- Of the total area burned each year from 1984 to 2014, the proportion of burned land suffering severe damage has ranged from 5 to 21 percent (see Figure 3).
- Land area burned by wildfires varies by state. Fires burn more land in the western United States than in the East, and parts of the West and Southwest show the largest increase in burned acreage between the first half of the record (1984–1999) and the second half (2000–2014) (see Figures 4 and 5).

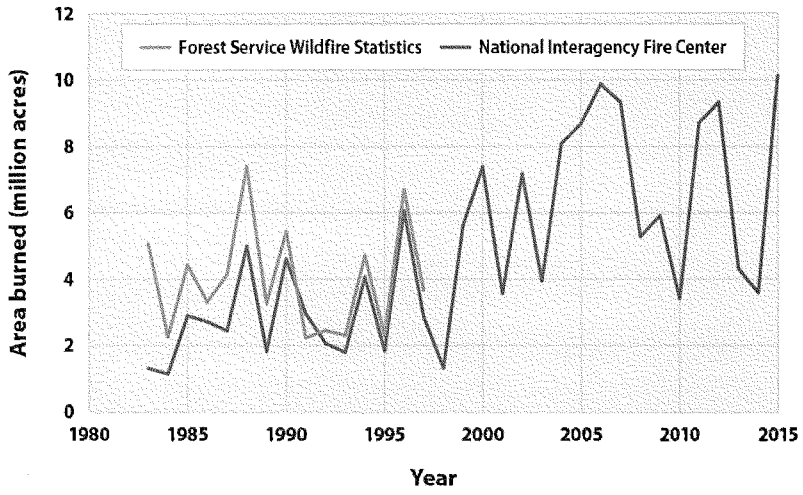
Figure 1. Wildfire Frequency in the United States, 1983–2015



This figure shows the total number of wildfires per year from 1983 to 2015. These totals include all reported wildfires, which can be as small as just a few acres. The two lines represent two different reporting systems; though the Forest Service stopped collecting statistics (orange line) in 1997 and will not update them, those statistics are shown here for comparison.

Data source: NIFC, 2016;[13] USDA Forest Service, 2014[14]

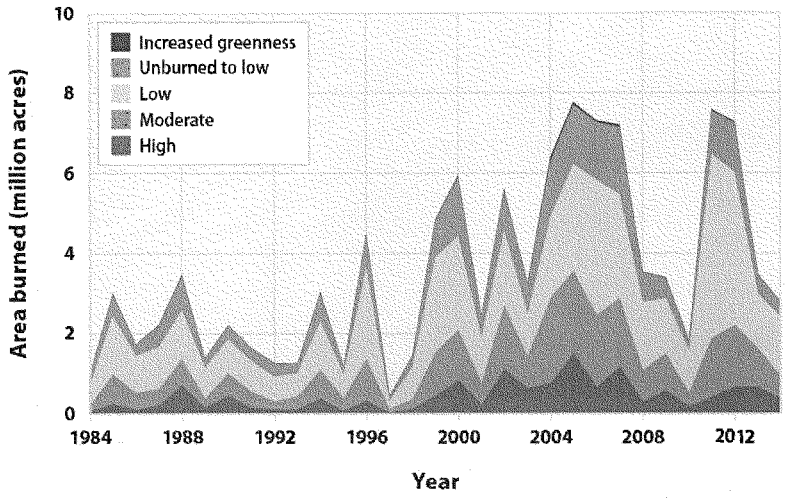
Figure 2. Wildfire Extent in the United States, 1983–2015



This figure shows annual wildfire-burned area (in millions of acres) from 1983 to 2015. The two lines represent two different reporting systems; though the Forest Service stopped collecting statistics (orange line) in 1997 and is not planning to update them, those statistics are shown here for comparison.

Data source: NIFC, 2016;[15] Short, 2015[16]

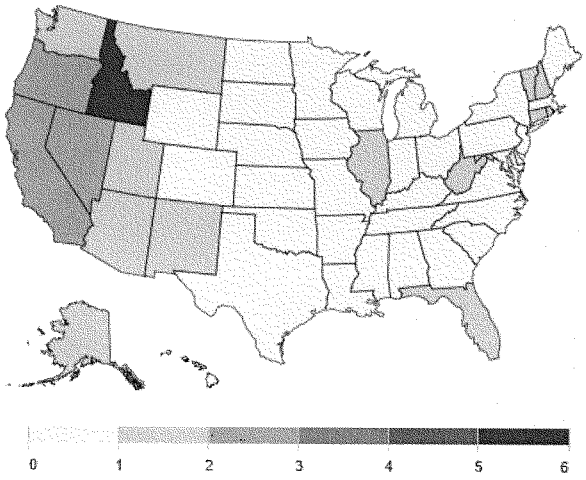
Figure 3. Damage Caused by Wildfires in the United States, 1984–2014



This figure shows the distribution of acreage burned by large wildfires, based on the level of damage caused to the landscape—a measure of wildfire severity. Large wildfires are defined as fires with an area larger than 1,000 acres in the western United States and 500 acres in the eastern United States. The total acreage shown in Figure 3 is slightly less than the total in Figure 2 because Figure 3 is limited to large fires and because a few areas did not have sufficient satellite imagery to allow damage to be assessed.

Data source: MTBS, 2016[17]

Figure 4. Average Annual Burned Acreage by State, 1984–2014

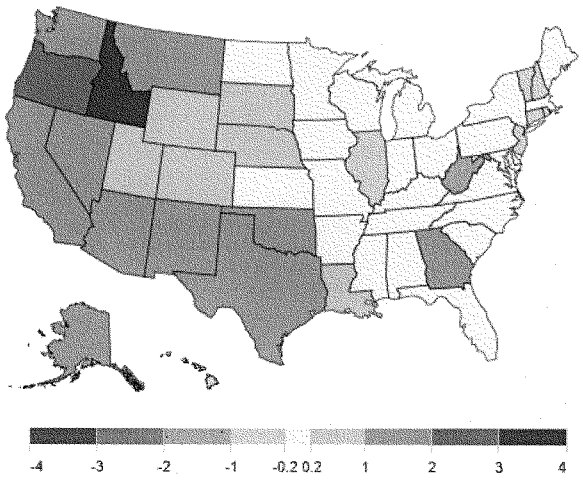


States colored light gray did not have any fires that were large enough to be included in this analysis.

This map shows the average number of acres burned in each state per year as a proportion of that state's total land area. Darker-shaded states have the largest proportion of acreage burned. For reference, there are 640 acres in a square mile; therefore, an average burned area of 6.4 acres per square mile would mean that fires burned 1 percent of a state's total land area. A few states did not have any fires that were large enough to be included in this analysis. Visit this indicatar anline at www.epa.gov/climate-indicators for an interactive version of this map.

Data source: MTBS, 2016[18]

Figure 5. Change in Annual Burned Acreage by State Between 1984–1999 and 2000–2014



States colored light gray did not have any fires that were large enough to be included in this analysis.

This map shows how the number of acres burned in each state as a propartian of that state's total land area has changed aver time, based an a simple comparisan between the first half of the available years (1984–1999) and the secand half (2000–2014). For reference, there are 640 acres in a square mile; therefare, a change of 6.4 acres per square mile wauld mean that burned area increased by 1 percent af a state's total land area. A few states did nat have any fires that were large enough to be included in this analysis. Visit this indicator online at www.epa.gov/climate-indicators for an interactive version of this map.

Data source: MTBS, 2016[19]

Indicator Notes

Many environmental impacts associated with climate change can affect wildfire frequency, extent, or severity, including changes in temperature, precipitation, and drought. Human activities and land management practices also affect wildfire activity, and preferred practices in wildfire management have evolved over time, from older policies that favored complete wildfire prevention to more recent policies of wildfire suppression and controlled burns. While this indicator is limited to "wildland" fires, it includes fires that encroach on—or perhaps started in—developed areas. Increased development in previously wild lands could also influence trends in wildfire frequency and extent. The total number of fires may

also vary due to reporting irregularities, as fires that split or merge together across jurisdictional lines may be counted differently.

Along with the influence of ongoing climate change, wildfire patterns can be influenced by natural climate cycles that tend to shift every few decades. Thus, the approximately 30 years of data shown here may not be enough to draw conclusions about long-term trends. While a longer record would be ideal, data from before 1983 are not consistent enough nationally to be included in this indicator.

Data Sources

The full set of wildfire frequency and burned acreage data in Figures 1 and 2 comes from the National Interagency Fire Center, which compiles wildfire reports sent from local, state, and federal entities that are involved in fighting fires. These data are available online at: www.nifc.gov/fireInfo/fireInfo_statistics.html. Additional data were provided by the U.S. Forest Service based on a different set of records, referred to as Smokey Bear Reports. Burn severity data and state-by-state acreage totals in Figures 3, 4, and 5 come from a multi-agency project called Monitoring Trends in Burn Severity, which maintains a database of wildfire events across the United States. These data are publicly available at: www.mtbs.gov/data/search.html.

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Wildfire Season Is Scorching the West

By Andrea Thompson

Published: July 28th, 2017

The West is ablaze as the summer wildfire season has gotten off to an intense start. More than 37,000 fires have burned more than 5.2 million acres nationally since the beginning of the year, with 47 large fires burning across nine states as of Friday.

Smoke rises from the Goodwin Fire, which burned more than 28,000 acres in Arizona through mid-July.
Credit: Prescott National Forest/flickr

The relatively early activity is quickly becoming the norm, with rising temperatures making the fire season longer than it used to be. The warming fueled by greenhouse gases is also helping to create more and larger fires as it dries out more vegetation that acts as fuel for fires.

This new fire situation means that western states need to be begin to rethink how they prepare for and combat fires, as well as how fire-prone land is developed.

Five large fires (those of 1,000 acres or more) are currently raging across California, the largest of which is the Detwiler fire near Yosemite National Park, which has burned more than 80,000 acres since it ignited on July 16. That fire is now 75 percent contained, but it destroyed dozens of buildings, including 63 homes.

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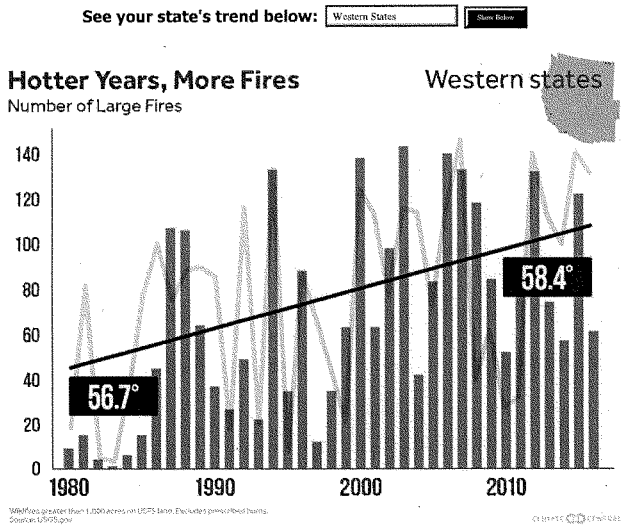
Montana currently has the most large fires of any state, with 14, including the massive Lodgepole Complex fire (a series of smaller fires that merged into one), which has burned more than 270,000 acres in the eastern portion of the state. That fire is also well-contained, but has burned through tens of thousands of acres of rangeland, displacing thousands of cattle and burning several structures. An intense drought there has rapidly cured the grasses that have fueled the fires.

Oregon has seven large fires burning, while Nevada has six and Idaho five.

Scorching temperatures and dry conditions in recent weeks have helped fuel these fires across the region, which have burned 2 million more acres than at this point in last year's wildfire season.

Compared to the 10-year average of wildfire activity, this year is below average for the number of fires, but above average for the total number of acres burned. A very active wildfire season in the Central Plains pushed up the acres burned; a wet winter meant grasslands were ripe with fuel, and once hot and dry weather came and fires ignited, they could take off more quickly than fires that burn through forested areas, Robin Broyles, a spokesperson for the National Interagency Fire Center, said.

A 2016 Climate Central analysis showed that the annual number of large fires has tripled since the 1970s and that the amount of land they burn is six times higher than it was four decades ago.



Number of wildfires in these states

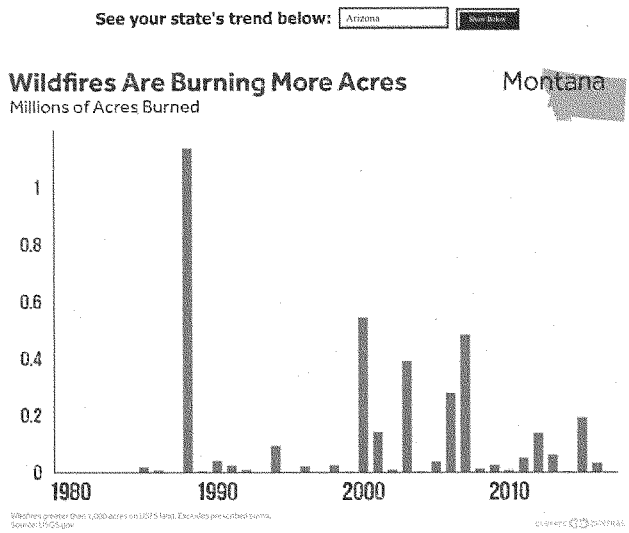
While multiple factors, including land use and tree disease, influence fire activity, climate change is playing a role in those trends. A study published in October found that rising temperatures accounted for nearly half of the increase in acres burned, as they helped to dry out forests and extend the length of the fire season.

The fire season is 105 days longer than it was in the 1970s, the Climate Central analysis found.

The lengthening of the fire season has become clear in California, which usually didn't see major fires until the Santa Ana winds kicked in in the fall and vegetation had dried out over several months.

Now bouts of hot, dry weather are coming earlier and earlier, setting the stage for prime fire conditions. Southern California already has a nearly year-round fire season, Scott Stephens, a professor of fire science at the University of California, Berkeley, said.

With those hot periods likely coming earlier and earlier in spring and summer as global temperatures continue to rise, "you're going to have a longer period where fire can ignite and move," Stephens said.



Acres burned by wildfires in these states

While the past few years in California have seen wildfires fueled by the record-setting drought in the state that killed off swaths of trees, this fire season has been helped by the opposite conditions. Ample winter rains allowed grasslands to flourish, so when hot, dry conditions came in June, those grasses were quickly cured into perfect fire fuel, Stephens said.

With the shifts in the fire season, policymakers and fire managers may have to begin to rethink some of their strategies for preventing fires, particularly as the longer fire season eats into the time that managers have to conduct prescribed burns to burn up potential fuel, Stephens said. Areas may also have to do more prescribed burns during drought years, to reduce fuel loads, he said.

Funding for firefighting — the costs of which have topped $1 billion in 12 of the past 15 years — may also have to be rethought. Instead of having a seasonal firefighting team, funding may have to be put in place for a year-round one, Stephens said.

Hot and dry conditions are expected to persist across the West over the next few days, which could help more fires start and spread. Areas in the path of next month's solar eclipse, particularly drought-plagued Montana, are also concerned about the influx of eclipse watchers who may not be aware of the fire danger or the precautions they'll need to take in order to avoid accidentally setting one.

"It's really important that people recognize" that danger and are aware of the various fire restrictions in place, Broyles said.

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Posted in ***Climate Statistics, Trends, Climate, Extremes, Drought, Heat, Wildfires, United States, West***

Comments

By Lewis Cleverdon (Central Wales)
on July 31st, 2017
Andrea - I'm afraid there are three rather obvious gaps in your article.

1/. - A 30% rise in 30yrs of the volume of necromass on the forest floor was shown by the 30-yr >500-site study of the Amazon Rainforest [Brennan et al, 2016] to be a direct consequence of the observed acceleration of the forest's metabolism due to elevated CO_2. That scale of effect is not a local phenomenon, and no study I've seen has even attempted to show why US forests would not be similarly affected. A 30% increase in necromass has to be a large part of the rising intensity, extent and duration of US forest wildfire. Surely this information is a critical part of the reader's proper understanding of the worsening US predicament ?

2/. - The metric of change in wildfire occurrence that really matters, as well as being the most cogent, is the tonnage of CO_2 and CO_2-e emitted. It is readily calculable from the known tonnages of carbon in different densities of tree-cover, less observed remains of charred trunks or stumps (that will rot down with both CO_2 and CH_4 outputs). If scientists are not yet providing that information, then surely the proper role of a journalist like yourself is to criticize their failure until they do so ? You would naturally apply this technique to improving other professions' conduct - such as farmers, miners and politicians, so why not scientists ?

3/. - The absence of any consideration of the consequences of rising wildfire losses, with their huge carbon footprint added to the ~45% excess airborne anthro-CO_2, is the most glaring gap in the article. With forests increasingly failing to regenerate after wildfire - due seed heating or combustion, &/or intensifying droughts, &/or colonization by invasive species, Forest Loss is one of the eight Major Interactive Feedbacks that are now reported to be accelerating worldwide. In addition to forests' increasing failure to regenerate (whose CO_2 is thus not recovered) those forests that do regenerate will take up to a century to recover the carbon that was released, thus leaving many billions of tonnes of CO_2 in the atmosphere during the regeneration period. Taking a conservative average of 40Ts of carbon per acre of forest, a 5m acre burn-year would release ~200MTC or ~730MTCO_2 /yr, and that is just from US forests that form a small fraction of the global acreage, and that is before accounting the CO_2e of the cocktail of high-potency GHGs released by forest fire alongside CO_2. So why is Climate Central not addressing this and the other seven Major Interactive Feedbacks as issues of critical self-reinforcing importance ? Do you realize that it gives the impression that you may be accepting the editor's instruction not to mention them, which degrades both your reputation as a journalist and the site's credibility ?

I hope that you will take the time to respond to the constructive criticisms above, and that you will accept that their motivation arises directly out of our shared concern for the resolution of Climate Destabilization as swiftly as possible.

Regards,
Lewis

Reply to this comment

By Dave (Basking Ridge, NJ 07920)
on July 31st, 2017
Excellent comment Lewis. Thank you.

Unfortunately, there is very little open public discussion in general about climate change to begin with let alone any seriously attempted public drill down into such esoteric aspects of it as positive feedbacks with complex interactions, non linear responses, and discussions of that in relation to the results of analyses, reported studies and observations, and so on. In other words, those things that have to do with the actual mechanics of catastrophic climate tipping points. Of course, it is far beyond the scope and capability of US MSM.

In my experience, the CC reports are often interesting and many that I have read have been well written. That comment is deserved. But of course the climate is indeed changing. As such there is no such thing as a climate status quo. And we know that it is all happening so much faster than was envisioned even just ten years ago. We therefore clearly need to be paying close attention to, and discussing the current trajectory of this a lot more comprehensively and seriously than has been the case at any time before.

Unfortunately, Climate Central, an obvious candidate forum for such types of discussions is failing in this regard. Instead, CC stories are usually cropped and often ignore deeper contextual and often profound issues that are associated with them. And in that respect, CC seems to have a specific major blind spot to do with objectively describing the implications of the obvious high rate of current climate change and the correspondingly near inevitable track of that trajectory versus the common PC MSM versions. Such versions include the 'tried and trusted' "...so as to constrain to 2C or less" and similar - sad Pollyanna optimisms that are now clearly technically immature to the point of absurdity.

There used to be a children's TV show called "Lost in Space". It featured a space traveling family that was literally lost in space. The family had a robot protector that could sense imminent life threatening danger and alert the family. In almost every episode such an emergency would arise and it would cry out something like "Danger, danger Will Robinson" and wave its arms about. I liked that robot. I think we should have a climate emergency analog of that robot to warn "Earth's civilization". Not quite The Day the Earth Stood Still variety of robot, but we obviously need something attention grabbing. But until then...

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With Warming, Western Fires May Sicken More People

By John Upton
Follow @johnupton

Published: August 19th, 2016

Shrouded by smoke from a fire in California's parched San Bernardino Mountains, schools in the Victor Valley closed their doors last week. The Pilot Fire was contained on Monday — shortly before the Blue Cut Fire broke out, billowing soot and ash over the valley afresh, forcing further closures.

"This is a pretty unprecedented situation," said Violette Roberts, a Mojave Desert Air Quality Management District official whose job involves warning residents in the area about air pollution. On Monday, "the sky had turned dark," she said. "It looked like it was sunset most of the day."

Smoke from the Blue Cut Fire over southern California.
Credit: Doc Searls/flickr

As the district warned valley residents to "limit time spent outdoors" and to seek medical care for respiratory ailments, school and health clinic closures and canceled sporting events were reminders that health impacts from wildfires carry further than the flames.

In the West, where populations living near forests and scrublands are growing, global warming is projected to fuel worsening wildfires, mostly by drying out the land. Research published this week showed how those forces will combine to cause wildfire pollution to threaten tens of millions more people during the years ahead than are currently at risk.

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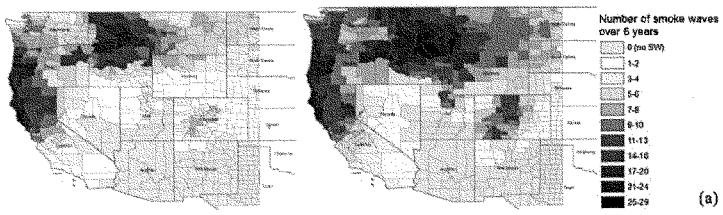
"When you have a wildfire, like a really bad wildfire, you can see that the air quality is reduced," said Brooke Anderson, a Colorado State University epidemiologist who worked on the new study, published in the journal Climatic Change. "These ambient air pollutants can reach a lot of people."

Researchers like Anderson have taken to using the term "smoke wave" to describe the type of multiday impacts from wildfire pollution that were experienced this month in the Victor Valley. The valley contains hundreds of thousands of residents as well as the thoroughfare linking Las Vegas with Los Angeles.

Anderson and scientists from Yale and Harvard calculated that 82 million residents of the West will experience smoke waves that are two days or longer during a six-year period beginning in the late 2040s. That's a 44 percent increase from a six-year period last decade.

"We discovered that, indeed, fires will become worse in the future, and that the number of people exposed to what we call smoke waves increases by about 35 million," said Loretta Mickley, an atmospheric chemist at Harvard who helped lead the study.



Frequency of smoke waves in the West from 2004 to 2009 (left) compared with projections for 2046 to 2051 (right). Credit: Liu et al., "Particulate Air Pollution from Wildfires in the Western US under Climate Change," Climatic Change, 2016.

The researchers combined population projections with the outputs of models designed to predict fire risks as greenhouse gas pollution continues to build up in the atmosphere. They also used a model to project the spread of plumes of air pollution from the flames.

On a per-county average, the group estimated that the number of smoke waves experienced in the West will increase to about 1.5 each year by the 2050s, up from about one today. The smoke waves are also projected to become more intense -- with air pollution during the worst smoke waves expected to worsen more than 400 percent.

Not all counties will be equally affected. Some may experience fewer smoke waves as the climate changes, though most were projected to experience worsening conditions. Communities located in or near forests face the worst impacts.

"Arizona does get much bigger fires in the future, but because it's so grassy there, there's not a lot of fuel for those big fires," Mickley said. "These fires can threaten homes, but you don't get the same massive smoke events."

The research was lauded by other scientists for its sophisticated and novel approach.

"It's as good if not better than anyone else is doing," said Christine Wiedinmyer, a National Center for Atmospheric Research scientist who was not involved with the study. "They've come up with a nice way of predicting fires — both now and into the future."

The Los Angeles Fire Department responding to the Blue Cut Wildfire in San Bernardino County.
Credit: LAFD/flickr

Wiedinmyer said the findings point to a need to better manage Western forests with more prescribed burns, which simulate natural conditions and clear forest floors of potential fuel. "Of course, you're going to get emissions there," she said, but risks of smoke waves from wildfires "might be reduced."

The research focused on fine sky-darkening particles called PM2.5 pollution. Such pollution is one of the world's main killers, posing risks in particular to children, the elderly and the sick. It's released by fossil fuel-burning power plants, internal combustion engines and wood burning.

"This type of approach provides a much more expansive and complete view of the potential consequences for humans as we change our climate," said Kevin Anchukaitis, a climatologist and geographer at the University of Arizona who wasn't involved with the study. "It shows the complicated yet robust link between climate change and human health."

The scientists didn't focus on other kinds of air pollution created by wildfires, such as chemicals that combine in the atmosphere to form ozone pollution.

"The direct effects on human health would be much greater for PM2.5 than for the ozone," said Lesley Ott, a scientist at NASA who wasn't involved with the study. "This is probably the most direct threat to human health."

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Climate Change Behind Surge in Western Wildfires

By John Upton
Follow @johnupton

Published: October 10th, 2015

Western firefighting veterans lamenting a "new normal" amid surging forest fires have received an explanation for the destructiveness they've been unable to quell. Rising temperatures are flatly to blame for recent fearsome fire seasons, leading scientists reported Monday.

The number of acres of forest burning yearly in large Western fires ballooned nine-fold from 1984 to 2015, with climate pollution and natural changes in the weather playing roughly equal roles in driving the deadly trend, research published in Proceedings of the National Academy of Sciences concluded.

The Erskine Fire spread so quickly in southern California earlier this year that some residents died before they could flee.
Credit: John Upton/Climate Central

The study showed that more than a century of fossil fuel burning, deforestation and farming has helped push the American West into an explosive new wildfire regime, and the findings suggest far worse could be ahead.

"The authors clearly demonstrate that a human influence on wildland fire as a consequence of global warming isn't just a prediction for the future — it's happening now," said Kevin Anchukaitis, a University of Arizona scientist who was not involved with the study.

Previous efforts to link Western wildfires with climate change have hinted at a profound relationship but led to unconvincing results, largely because long lists of factors influence ignition and wildfire properties.

Monday's study focused on forest dryness, identifying the commanding role it has been playing in driving fires. The researchers relied on climate data and modeling to present a sweeping regional view of 30 years of worsening forest fires.

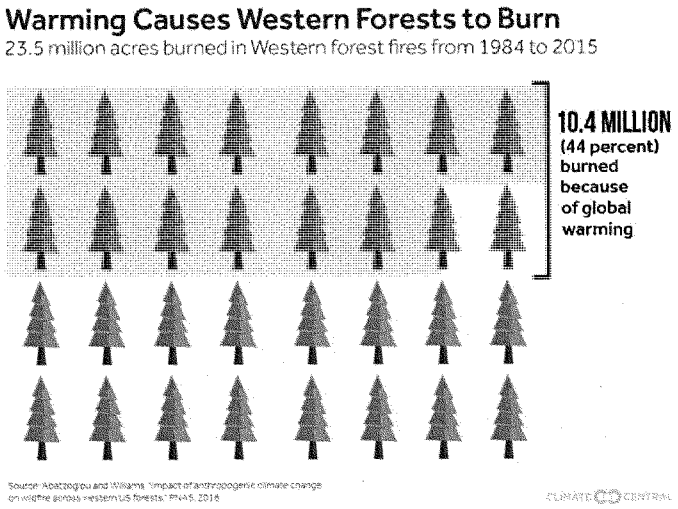
RELATED | **Dead Trees Adding to California Firefighters' Battle**
With Warming, Western Fires May Sicken More People
Pacific Northwest Warming May Have Natural Roots

"The exact percentage of human contribution remains uncertain, but the overall relationship — an increase in fuel aridity, fire days, and fire extent — is clear and significant," Anchukaitis said. "The statistical analysis is very convincing and elegantly done."

Western wildfires have been devouring forests parched by higher temperatures in recent years, draining federal and local firefighting funds, killing residents unable to flee fast-moving flames and filling skies with sometimes-crippling levels of air pollution.

The new analysis showed temperature increases caused by rising levels of greenhouse gas pollution have had a drying effect on Western forests that caused 10.4 million acres to char in large fires during the three decades.

That suggests 44 percent of the forest area that burned during the three decades analyzed burned because of the effects of global warming. The finding was an estimate, with the researchers concluding global warming likely drove between 6 million acres and 16 million acres of forest fire.

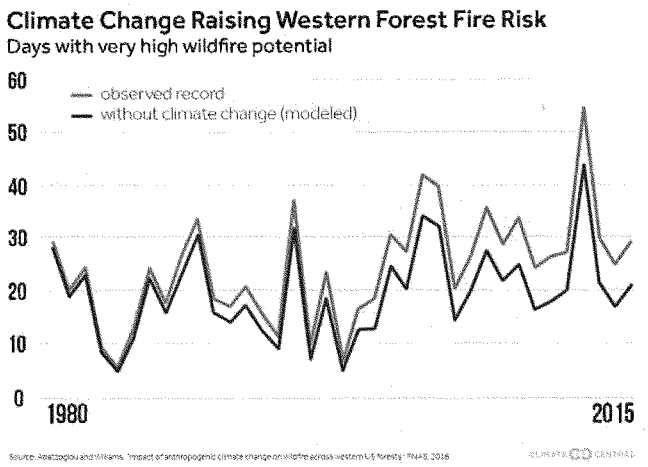


Greenhouse gas pollution was also found to have extended fires seasons and caused additional days of severe fire danger.

The "compounding effects" of climate change and natural weather fluctuations are "giving rise to this remarkable increase in forest fire activity," said John Abatzoglou, a geographer at the University of Idaho who coauthored Monday's paper.

Even as greenhouse gas pollution has warmed the planet's surface in recent decades, warming rates across the West have been exceptionally rapid. That's largely because of the effects of a slow-moving ocean cycle, the Pacific Decadal Oscillation, which influences the global climate.

Warming caused by natural climatic variation was blamed for the burning of 11.4 million acres of Western forests during the study period — slightly more than the effects of warming caused by humans.



The study focused on the heavy role that temperatures can play on forest fires, ignoring other kinds of wildfires, such as those afflicting grasslands, and ignoring other factors that can shape fire seasons. Fires need ignition sources to get started — these include lightning strikes, arsonists and campfires. They're also affected by the thickness and type of vegetation that they consume, which in turn are shaped by weather, climate and wildfires.

"While this paper is an important contribution, we still face several open questions about other drivers of change on fire regimes," said Max Moritz, a fire ecology and management scientist at the University of California, Berkeley. He was not involved with the research.

"We're going to have more wildfire on many of these landscapes," Moritz said. "We need to re-examine where and how we build our communities, so that we can learn how to better coexist with wildfire — similar to how we've adapted to other natural hazards."

California Gov. Jerry Brown and Nevada Sen. Harry Reid have directly linked the "new normal" of Western wildfires with global warming. Monday's findings lent scientific credence to these claims.

"The effect of warming on fire activity is actually exponential," said Park Williams, a scientist at Columbia University who produced Monday's study with Abatzoglou. "That means that every degree of warming has a bigger impact than the previous degree of warming."

A United Nations climate treaty will take force next month that's designed to spur nations to work together to reduce their impacts on the climate, such as by ditching coal energy in favor of cleaner alternatives. Exhaustive work and escalating political commitment will be needed if the civilization-saving potential of the Paris climate agreement is to be realized.

"Even though climate is changing gradually, the way that fire responds is not gradual," Williams said. "As warming continues, there will probably be another leap, where fires are getting quite a bit more energetic — and quite a bit larger."

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Comments

By Geoff Beacon (UK)
on October 11th, 2016
The increase in forest fires is missing from IPCC climate models.

Climate will be worse than predicted.

http://www.brusselsblog.co.uk/missing-feedbacks-ignored-by-ipcc-models/

Reply to this comment

By entrance (Austria)
on October 11th, 2016
The problem is that there are too many people on this Earth. Nice graph:
https://upload.wikimedia.org/wikipedia/en/3/3a/Human_populatinn_growth_from_1800_to_2000.png

Overpopulation causes a lot of problems, not just only air pollution and global warming, but also mass extinction of animal species, water pollution, increasing difficulties to supply water and food, increased emergence of new epidemics and pandemics, elevated crime rate, and so on. A graph that shows the direct relationship between world population and CO2-emissions: http://www.marketcalls.in/wp-content/uploads/2010/11/Correlation.jpg

If we were able to solve this main problem overpopulation, we would automatically solve the mentioned problems too.

I am ready to help.

Reply to this comment

By Brother Raphael (massillion, Ohio)
on October 11th, 2016
I think climate change has affected the writer's brain..

Reply to this comment

By Nina Horsley (Cave Junction, OR 97523)
on October 13th, 2016
Last year in Oregon there were 202 fires. A large percent caused by logging operations, Oregon Dept. of Forestry. This year over 400, KOBI5 news, over 1.5 Billion dollars this year in suppression costs.

I live here next to our federal BLM forests, that used to moist and thick and full of a diverisity of all species of life, in 20 years it has reached the point, that if they do follow thru with the East/West junction timber sale, do allow the timber industry to cut it, to go thru and remove every tree over 8" in diameter, it will completely destroy the water supply of the Illinios Valley, in Josephine County, Oregon. And contribute to the demise of at least 5 river systems, in Southern Oregon and Northern California.

Based on the rate of over thinning on public forest land, and the clear cuts on private timberland, coupled with the use of pesticides, we have destroyed our forests ability to maintain it's own moisture levels and provide us with our water, our most precious resource. Without forests there is no reliable water cycles.

Forests absorb large amounts of water all rainy season long. Holds it until the temperatures increase to the point where trees then evaporate moisture into the atmosphere, which then starts our winter water cycle again. No more we have broken the back bone of our planets forests.

This is the reason the wild fires are up. That and the fact that we changed our approach to fighting fires. It's become a muti-billion dollar boon to those that own business', in the timber industry, who send people out to fight them, and you get to cut down the trees that may not be dead, but the fire gives the industry another way to make money off of a system that is self-serving to the point of self-destruction, killin millions of peoples water suppy.

My local lumbermill started a forest fire last year thru sheer stupidity, and they still to this day, have not been held responsible, for the fire. They were unable to stop the fire before it burned down a neighbors house and out building, jump the river and come within 1000 ft from my home, and put my neighborhood in line for a direct hit to a completely avoidable event.

Nor is BLM enforcing the laws to protect our water suppy, to maintain permanant forestry production, all facets, protect our water shed.

I apologizes for ranting, these are just the facts that I have seen happen before my own eyes, 50 years of playing, living, working and feeding from the forests. They give us more than just lumber. It's not too late to stop destroying the forests that provide us with water, they can recover if we just stop logging, thinning and spraying, and to put the fires out, instead of watching them burn down and rip up large swatched of forests with bulldozers that are no where near the fire. Just to increase the rate of timber harvests.

No self respecting farmer intentionally destroys the very plant they need to make a living or survive on, but the timber industry, going from country to country, raping the land. Accept the petro, coal and chemical industries, they are poisoning our water supply faster than anyone could imagine, look at Flint, Michigan, North Dakota, the oil sand tar pits in Canada.

Reply to this comment

By Mal Adapted
on October 18th, 2016
Ms. Horsely, you are correct that forestry practices, along with decades of over-zealous wildfire suppression, have contributed to greater

wildfire activity in Oregon. This article explains why they are not the only reason for it.

The article links to another one on the relative contributions of natural and anthropogenic factors to the "exceptionally rapid" warming across the American west since the 1980s. There is no disputing that warming has occurred, though. It would be surprising if wildfire activity in the region had *not* increased as a result, even if there were no other changes like those you described. That's because the rate of evapotranspiration, by which plants take up water from the soil and release it to the atmosphere to drive photosynthesis, increases with the temperature. For plant communities, warming equals drying.

The growing season starts in Oregon when it's warm enough for trees to begin drawing on soil moisture that accumulated during the winter. With warming, growing seasons are beginning earlier; and reduced snowpack at higher elevations is leaving less water available in late spring, as rainfall tapers off. Now when the rains stop each summer, forests have already begun to dry out, so that fire season is beginning earlier as well.

I'm afraid it's all too easy to understand why Oregon is seeing more wildfires. In the long term, as warming continues we will see forests giving way to shrub- and grasslands, migrating north along the coast and higher into the Cascade mountains. It's what the pride of man has wrought.

Reply to this comment

By FRANK PAPCIN (virginia beach, va. 23452)
on October 17th, 2016
I'm 75 years old and remember reading about all of the fores on the west coast for most of them, even lived there for awhile.millions of acres being burned every year, with chocking fumes all over southern California being the normal thing—EVERY YEAR. 1 REASON i MOVED OUT OF THERE.
WHEN THEY USED TO TEACH HISTORY IN SCHOOLS, we were taught of the dry spell our country suffered from that spread all across our country—the great dust storms that we don't seem to get anymore.
it seems like all of the damage to humans out there was because more humans moved into the state cutting down all of those trees to live amund.- I remember our government deciding to let them burn—remember?
I remember a million areas burning in a year, more than once.
do I believe our planet is getting warmer?— AGAIN?—OF COURSE i DO, but that man is causing it.
I compare it to a flea on a rhino's hide hurting her.
I trust my government as much as I think that the Rhino can swat that flea off, if it even knew it was there.

Reply to this comment

By Mal Adapted (Kennewick, WA 99336)
on October 17th, 2016
Mr. Papcin:

"do I believe our planet is getting warmer?— AGAIN?—OF COURSE i DO, but that man is [not?] causing it.
I compare it to a flea on a rhino's hide hurting her.
I trust my government as much as I think that the Rhino can swat that flea off, if it eveu knew it was there."

If you don't trust your government's data, why do you believe it's getting warmer? Whose data do you trust?

You say you don't believe man is causing global warming, because you believe humanity's ability to affect the Earth's climate is comparable to "a flea on a rhino's hide". To be blunt, this is the argument from ignorance, or as Carl Sagan called it "the argument from personal incredulity". At 75, you're hardly too old to consider the evidence. The conclusion that the current warming is anthropogenic stems from three facts:

1. CO_2 traps heat in the atmosphere, and that adding more CO_2 to the atmosphere traps more heat. That was shown in the 19th century, by a Frenchman, Joseph Fourier (1826); an Englishman, John Tyndall (1859); and a Swede, Svante Arrhenius (1896).

2. Atmospheric CO_2 has increased from about 275 ppm in 1750 to 405 ppm in 2016. That's based on samples of atmospheric gases trapped in Antarctic ice, and since 1959 on direct sampling of the atmosphere by Charles Keeling and his son Ralph.

3. Humans have burned about 500 billion tons of fossil carbon since 1750, about twice the amount needed to account for the increase in atmospheric CO_2. That's based on estimates by the Carbon Dioxide Information Analysis Center at Oak Ridge National Laboratory—your government's data, but again, if you don't trust you're governments data, whose do you trust?

Given 1 - 3, it would be astonishing if warming had not occurred. In fact, global mean surface temperature has risen at least 1 degree C since 1750, and about 0.75 degrees since 1959. No known natural factors can account for the increase over time. It is very hard to explain the increase in GMST any other way than that man has caused it by burning fossil carbon for energy.

Reply to this comment

By Noel Darlow (Scotland)
on October 22nd, 2016
A significant, long-term increase in fires must raise the question if a fundamental change in habitat from wooded regions towards more open savannah is underway.

Reply to this comment

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Email (required):

City/State/Zip:

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The Christian Science Monitor

ENVIRONMENT

In the West, communities pioneer cooperative approach to fighting wildfires

Instead of having understaffed towns try to do their own research in the middle of an emergency, the FAC Network offers a cooperative model where communities can share best practices and get help quickly.

Andy Nelson/The Register-Guard/AP | Caption

Jessica Mendoza
Staff writer | @_jessicamendoza

SEPTEMBER 21, 2017 | LOS ANGELES — For Annie Schmidt it began in

2014, with a stranger on a bus.

Ms. Schmidt was in Colorado Springs for a workshop held by the newly created Fire Adapted Communities Learning Network, or FAC Net. On the way to a field trip, she found herself sitting beside Justice Jones of the Austin Fire Department, discussing his extensive work on post-fire recovery.

Later that summer, as the Carlton Complex Fire tore through 256,000 acres of north-central Washington, Schmidt, then-director of the Chumstick Wildfire Stewardship Coalition in Leavenworth, Wash., remembered the conversation and called Mr. Jones. "I said, 'I need to know everything you know about recovery, like, yesterday,' " she says.

The information was a godsend for fire managers, who were stretched thin as hundreds of homes burned across Okanogan County, Schmidt says. "We didn't have the time or resources to have materials developed instantaneously," she says. "The ability to reach out and get some of these basic questions answered was huge."

The network is a milestone in the nation's changing attitudes toward wildfire, say fire management practitioners. Instead of waiting for the federal government or leaving understaffed towns try to do their own research in the middle of an emergency, it offers a cooperative model where communities can share best practices – empowering them to participate in developing their own resiliency to wildfire. "That's a really big shift in terms of people trying to understand wildfires instead of just responding to them," says FAC Net co-director Michelle Medley-Daniel.

Recommended: **Fighting wildfires: seven cutting-edge technologies**

As climate change leads to hotter, drier summers, and populations grow in fire-prone regions, fire professionals have increasingly turned to strategies beyond suppression, or putting fires out as quickly as possible. "It's almost a shelter-in-place mentality," says Max Moritz, a specialist in fire ecology and management and a professor at the College of Natural Resources at the University of California, Berkeley. "If we're going to see more events that are more extreme ... we're going to have to learn to live in tune with the natural hazards of the environment where we are."

Today FAC Net – born from collaboration among The Nature Conservancy, the US Forest Service, and The Watershed Center – consists of two dozen members, including fire departments, nonprofits, and conservation districts whose goal is to build relationships within and among fire-prone communities nationwide. Another 80 or so affiliate groups participate in workshops, access resources and tools online, and share with one another decades of wisdom around wildfire resilience.

When 'boots on ground' aren't enough

For the past century the responsibility of managing wildfires has fallen largely to agencies – such as fire departments, the Forest Service, and the Federal Emergency Management Agency – that have dealt with fires in a quasi-military fashion. The structured, hierarchical nature of that response ensured clear command structures and communication in efforts to put out fires.

But the past 20 years have seen fires grow increasingly catastrophic. Part of it was the build-up of small trees, shrubs, and other flammable

debris that turned some communities into tinderboxes – a result of 100 years of fire suppression. As the West's summers grow hotter and drier, it has led to fire seasons that are as much as two months longer in states such as Montana.

At the same time, between 2000 and 2010 10 million new residences were built in the nation's wildland-urban interface – communities that either border or are on fire-prone land. As of 2013, 36 percent of US homes stood in the WUI, according to joint research from the Forest Service, the University of Wisconsin, and Oregon State University.

We had to "dispel this notion that if we only had enough airplanes, engines, boots on the ground, we'd be good," says Wendy Fulks, who facilitates FAC Net's major partnerships. "We know now that's just not going to work."

Legislation such as the Healthy Forests Restoration Act of 2003 and the Federal Land Assistance, Management and Enhancement (FLAME) Act of 2009 catalyzed community preparedness efforts across the country. By the time FAC Net was formed in 2013, there was a growing sense among practitioners that they needed more innovative ways of living with fire – and that one way to do that was to involve more people in their work. The network brought together for the first time communities that had for years been working to address wildfire issues in relative isolation.

"So often, we fall into the same routine of having a problem in our place and thinking it's just in our place," Schmidt says. But while every community has its own unique challenges when it comes to wildfire, she notes, they also have plenty in common. "Not only can we learn from each other to get better results, we can create new things together," she says. "In a capacity-limited, budget-limited world, [that]

is only the way we're going to tackle some of these big problems."

Learning from others

The network introduced Schmidt and the Chumstick coalition in Leavenworth to the organizers of Project Wildfire in Deschutes County and Ashland Fire & Rescue in Oregon. Since 2015, the three organizations have been in constant contact and held what they call learning exchanges: essentially field trips meant to showcase each community's expertise.

The 2014 and '15 wildfire seasons, for instance, left Washington State with plenty of recovery experience to share. Businesses' ability to operate during and after a fire was a popular subject. "If you have a wildfire and only half the staff comes in, what's the plan to operate at that level? Or say you have a loss of a key member [of your organization]. Who's going to step in and run that business?" says Alison Green, program director at Project Wildfire.

"It broadened out our thinking beyond just fuel-reduction projects and

firewise communities," adds Ed Keith, county forester of Deschutes County.

Mr. Keith has in turn provided both Ashland and Leavenworth with advice on applying for the Federal Emergency Management Agency's Pre-Disaster Mitigation Grant Program, saving them time and resources. "We were able to get a sense of how much work it would be and how effective it can be," says Alison Lerch of Ashland Fire & Rescue. "We didn't have to do everything anew."

Chris Chambers, also from Ashland, recalls taking a tour of Wenatchee, Wash., following the summer of 2015, when embers from a nearby fire ignited sections of the city's downtown. "Ashland has a similar topography, and it didn't really cross my mind that it could impact our downtown area," he says. "It was really eye opening for me."

Getting the network off the ground had its challenges. Investing in relationships takes time and energy, and that's a big ask of understaffed agencies facing a growing problem. The idea of a non-hierarchical structure can also be difficult to embrace for those used to dealing with top-down organizations, says Medley-Daniel, the FAC Net director. "It's about accepting complexity ... and it continues to be hard to unravel what we need to do," she says.

But for the most part, the benefits of being part of the network outweigh the trouble, FAC Net members say. The network's online platform – which include a blog and a forum that works almost like Reddit for members – makes it easy for communities nationwide to ask advice of each other and share ideas. FAC Net also provides small grants, and its staff helps connect individuals and agencies with counterparts that can best help solve their problems. "So we have this

suite of efforts aimed at helping places move further down the road in changing their relationship with fire," Medley-Daniel says.

It's the personal bonds, however, that members say they value most.

"It's the in-person relationships that makes you comfortable enough to pick up the phone and say, 'I'm about to ask for your time and your help,' and they're more inclined to answer," Schmidt says. "You're a person to them."

Material from Reuters was used in this report.

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Fighting wildfires: seven cutting-edge technologies

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By Doug Struck

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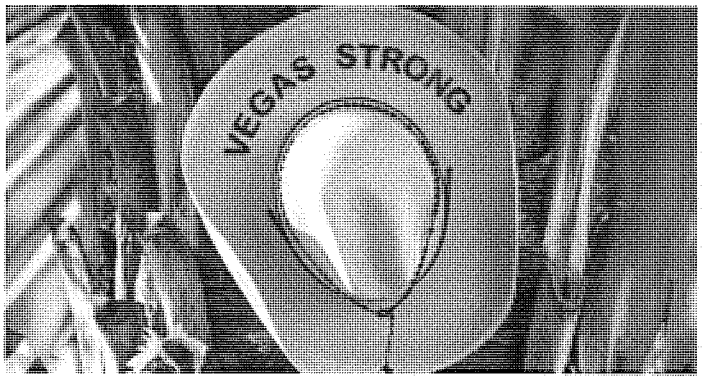
Wildfires threaten much of US West despite a wet winter

By Dan Elliot

INHABIT

Climate science slashed in Trump budget. Why does that matter?

By Henry Gass



PHOTOS OF THE WEEK

Photos of the week 10/09

News / Environment

Climate change expected to fuel larger forest fires — if it hasn't already

Extreme heat waves, such as the one torching the Southwestern United States and the one plaguing Western Europe, are frequently cited as one of the most direct effects of man-made climate change. (Getty Images)

By **Joshua Emerson Smith** • **Contact Reporter**

JULY 4, 2017, 1:20 PM

Global warming will likely heighten the risk of large, more difficult to control wildfires scorching the western United States.

It's the main conclusion of a body of science that, over the years, has increasingly drawn connections in the West between the prevalence of major blazes and the rising frequency of earlier springtime conditions followed by hotter and drier summers.

"Climate absolutely affects fire because it affects how flammable the fuels are," said LeRoy Westerling, a professor at UC Merced who has been studying climate and wildfires for the past 15 years.

"Your drought years are going to be more extreme because it's warmer during the drought years, so you have more evaporation, and those preceding years that were wetter are retaining less water," added Westerling, who has worked on these issues with colleagues at places like UC San Diego's Scripps Institution of Oceanography in La Jolla.

They and other scientists from Oregon and Washington state to California and Colorado have collaborated on improving long-range climate projections, developing more sophisticated computer modeling and creating customized equipment to better monitor weather and wildfire conditions, among other projects.

All of this work has continued to proceed despite escalating debate over the scientific validity of climate change forecasting — in the courts between regulators and major companies, in divisive policies from the White House to statehouses to city councils, in dueling marketing campaigns between conservationists and the fossil fuel industry, in testy exchanges among world leaders about whether particular countries are truly committed to lowering their greenhouse-gas emissions.

This year alone, global warming has been the subject of much attention.

In his proposed budget, President Donald Trump calls for slashing the budgets of two federal agencies most associated with climate change research and enforcement — the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration.

Then in late May, he announced that the United States would withdraw from the Paris climate change accord, in which almost every country has pledged to reduce emissions of carbon dioxide and other gases linked to Earth's warming. Trump has set off a cascade of voices worldwide praising or denouncing the decision.

Scientists, environmentalists and others have tried to put forth their own message

directly to consumers, including through rallies such as the March for Science at several hundred locations across the U.S. in April.

The research on climate change and wildfires in the western U.S. has largely escaped this escalating controversy, perhaps because the body of evidence collected has consistently pointed to the same trend of mega wildfires happening more frequently.

Westerling systematically cataloged wildfires in the western U.S. over several years and found that in the mid-1980s, fires in U.S. forests steadily started getting larger and burning longer.

The number of fires that burned more than 1,000 acres on federally managed lands from the Pacific Northwest to the Sierra Nevada and through to the Southern Rockies increased fivefold in the last three decades, according to his research.

From 1973 to 1982, the average wildfire burned for six days. Between 2003 and 2012, that figure shot up to 52 days.

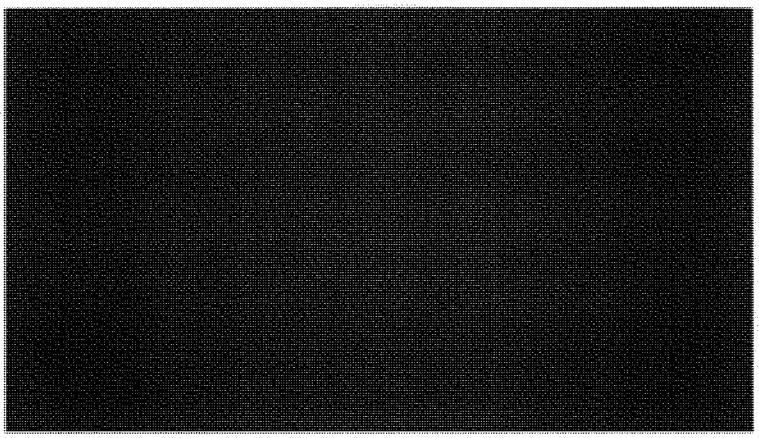
While the number of reported ignitions remained steady, the acreage burned by large fires between those time frames increased by up to 1,200 percent.

At the same time, the so-called fire season expanded. That's the number of days between the first and last large blazes of any given year. Since the 1970s, the 10-year average increased 84 days from 138 to 222.

Westerling predicts that as a result, forest compositions in certain regions could dramatically change. Instead of large older trees, woodland areas may become populated with younger, smaller trees that burn more often.

If this happens, large forests in California could shift from ecosystems that suck up large amounts of carbon dioxide to those that give off significant amounts of greenhouse gas.

"Over time, what happens in our modeling, is the Sierra Nevada stores less and less carbon, and then these areas start becoming carbon sources instead of carbon sinks," he said. "So it starts contributing to climate change over the next couple of centuries."



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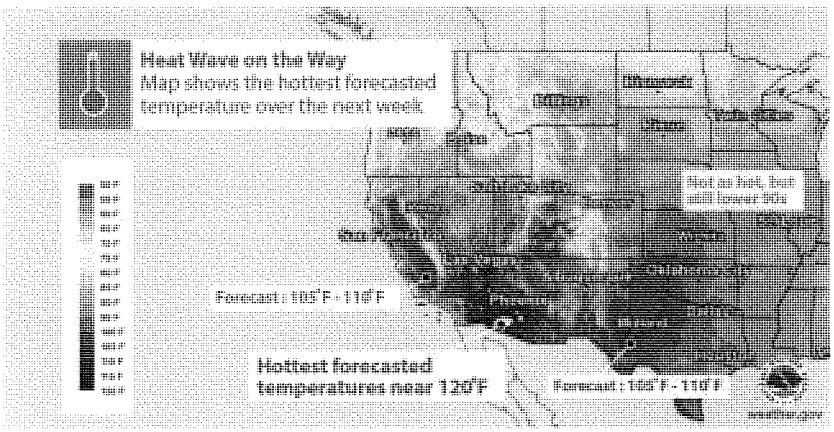
[BLOG] UNION OF CONCERNED SCIENTISTS

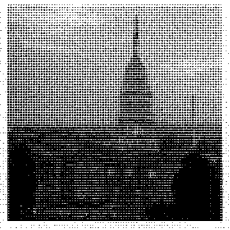


Heat Waves and Wildfires Signal Warnings about Climate Change (and Budget Cuts)

RACHEL CLEETUS, LEAD ECONOMIST AND CLIMATE POLICY MANAGER | JUNE 19, 2017, 3:39 PM EDT

Southern California and the Southwest US are experiencing a significant heat wave this week. More than 29 million people in California alone are under an excessive heat warning or heat advisory.

If you live in areas affected by this heat wave, please follow health advisories to stay cool, stay hydrated, and stay safe.



This post is a part of a series on **Understanding the Budget**

And watch for wildfire advisories while you're at it.

Heat waves are dangerous

Extreme heat can cause heat exhaustion, heat stroke, or even death. Symptoms to watch for include dizziness, headaches, nausea, muscle cramps, and loss of consciousness. Be especially vigilant for children, the elderly, those with pre-existing health conditions, those who work or play outdoors, and your pets. (For more on how to stay safe in extreme heat, refer to guidance from the CDC.)

Unfortunately, **climate change is increasing the frequency and severity of heat waves**. According to the EPA:

> *"Nationwide, unusually hot summer days (highs) have become more common over the last few decades. The occurrence of unusually hot summer nights (lows) has increased at an even faster rate. This trend indicates less "cooling off" at night."*

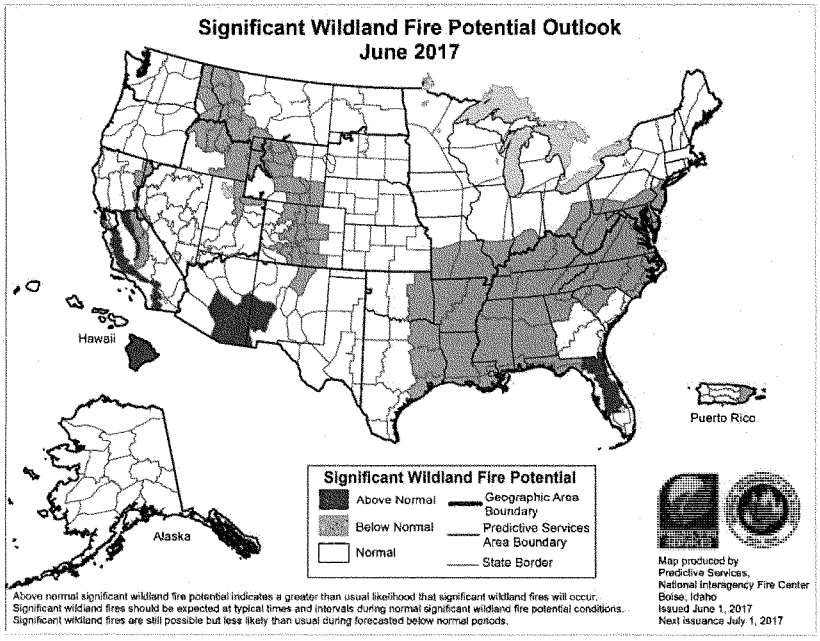
Furthermore, heat waves that arrive earlier in the summer can have worse health impacts because people's bodies have had less time to adjust to the warm weather. And the longer a heat wave lasts, the more severe the cumulative effects can be.

On the other side of the world, India has already experienced a serious early heat wave in April, and recent research shows that even a small increase in global average temperature (which is very likely with climate change) is projected to cause a huge increase in heat-related deaths there.

Hotter, drier conditions also raise risks of wildfires

The wildfire season in the Southwest is also underway. Many of the same areas experiencing this week's heat wave—including parts of Arizona, New Mexico, and California—are also forecast to have an above-normal wildfire risk this month (see map).

That's no coincidence: in many parts of the world hotter, drier conditions are also contributing to growing risks of wildfires.



Arizona currently has more than 12 active wildfires and the state has already seen dozens of fires this year. California has also seen a number of wildfires over the past month; officials warn that the risk continues to be high. Ironically, winter precipitation in these states has helped provide more fuel for fires, stimulating the growth of brush and other vegetation that is now drying out in the hot temperatures.

Halfway across the world, Portugal is experiencing terrible wildfires, where more than 60 people tragically lost their lives this past weekend after getting trapped by raging fires. The country is, of course, focused on the emergency response and is in a state of mourning. Unfortunately, Portugal has been experiencing bad wildfires seasons year-on-year. Earlier this year, Chile also experienced devastating wildfires.

Drought and extreme heat are important contributing factors in all these cases, and frequently faulty forest and land management policies are also implicated.

Managing the risks of wildfires

Wildfires are inevitably a consequence of several factors, including the weather, winds, and the condition of forests and underbrush, plus the proximate causes such as lighting or human activities. Here in the US and many parts of the world, climate change is making hotter, drier conditions more likely and worsening the risks of wildfire.

Development in wildfire-prone areas also exposes more people and property to the risks of harmful impacts. The smoke from wildfires can also impose harmful health impacts on people living hundreds of miles away—recent research shows that the air pollution from wildfires is significantly higher than previously understood.

To manage wildfire risks and impacts, we will have to work on solutions on all these fronts.

Cutting the Forest Service budget is a bad idea

Given what we know about these growing wildfire risks and the need to take robust action to protect people and healthy forests, the Trump administration's proposed cuts to the US Forest Service budget are a particularly bad idea. For instance, the president's FY 2018 budget proposes to cut funding for forest health management by about $9 million relative to FY2017 (more specifically, relative to the FY 2017 annualized Continuing Resolution level), which would reduce the resources available to cope with disease and pest outbreaks that kill trees. The hazardous fuels management budget would take a hit of $20 million—meaning that there would be less

money to manage or thin forests to reduce wildfire risks near where people live. The budget also proposes to cut funding for volunteer fire departments.

Last week Tom Tidwell, Chief of the USDA Forest Service, testified about the budget before the Senate Committee on Energy and Natural Resources. At the hearing, there was bipartisan push-back to these cuts. Senator Murkowski (R-Alaska) said:

> *"While some of the agency's recommended budget cuts are worth considering, others, like the proposed cuts to recreation programs, are concerning. Some could impact critical forest management activities, like firefighting and hazardous fuels reduction. And some appear to contradict other proposals in the budget, so we will need to review all of these very carefully, as we work on our budget for the next fiscal year."*

And Senator Cantwell (D-WA) said:

> *"President Trump's proposal reduces funding for fighting wildfires. This budget proposes a decrease of almost $300 million for fighting wildfires and another decrease of $50 million for preventing wildfires."*

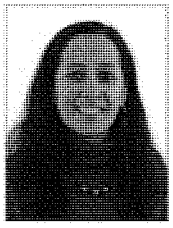
A way forward on wildfire and climate policy?

Senators Murkowski and Cantwell have a long history of working together to find solutions for improving forest management and fixing wildfire budgeting.

I hope Congress will reject the harmful budget cuts proposed by the Trump administration, and step up and pass legislation to address these critical issues as soon as possible. People who live in wildfire-prone areas—whether in California, Arizona, Alaska, or Georgia—cannot afford further delays or back-sliding.

We also have to continue to work with the global community to limit the heat-trapping emissions that are driving climate change and worsening the risks of deadly heat waves and wildfires worldwide—despite the Trump administration's stance on the Paris Climate Agreement.

Posted in: Global Warming Tags: Forest Service, heat wave, Understanding the Budget, Wildfire



Firefighters battle a wildfire near Mariposa, California. JOSH EDELSON/AFP/GETTY IMAGES

Stark Evidence: A Warmer World Is Sparking More and Bigger Wildfires

The increase in forest fires, seen this summer from North America to the Mediterranean to Siberia, is directly linked to climate change, scientists say. And as the world continues to warm, there will be greater risk for fires on nearly every continent.

BY NICOLA JONES • OCTOBER 2, 2017

On a single hot, dry day this summer, an astonishing 140 wildfires leapt to life across British Columbia. "Friday, July 7 was just crazy," says Mike Flannigan, director of the wildland fire partnership at the University of Alberta. A state of emergency was declared. By the end of summer, more than 1,000 fires had been triggered across the Canadian province, burning a record nearly 3 million acres of forest—nearly 10 times the average in British Columbia over the last decade. As the fires got bigger and hotter, even aerial attacks became useless. "It's like spitting on a campfire," says Flannigan. "It doesn't do much other than making a pretty picture for the newspapers."

Forest fires are natural. But the number and extent of the fires being seen today are not. These fires are man-made, or at least man-worsened.

"Evidence is becoming more and more overwhelming," says Flannigan, that climate change is spreading fires around the world. Globally, the length of the fire weather season increased by nearly 19 percent between 1978 and 2013, thanks to longer seasons of warm, dry weather in one-quarter of the planet's forests. In the western United States, for example, the wildfire season has grown from five months in the 1970s to seven months today.

The number-crunching now shows an increased risk for fire on nearly every continent, says Flannigan, though most of the work has focused on North America, where there is a larger pot of funding for such research. In the western U.S., where fires ravaged Oregon this summer, the annual burned area has, on average, gone from less than 250,000 acres in 1985 to more than 1.2 million acres in 2015; human-caused climate change has been blamed for doubling the total area

burned over that time.

Similarly, for fire-ravaged British Columbia, an analysis from this July estimates that climate change has made extreme fire events in western Canada 1.5-6 times more likely.

So how much worse are things set to get?

Pinning any specific environmental event on climate change is a tricky business, though the science of weather attribution has grown in leaps and bounds over the past decades. Individual wildfires are still near the bottom of the list of things that can easily be pegged to a changing climate, thanks to all the other factors in the mix. If people break up forests into smaller chunks through logging or agriculture, that can limit the spread of forest fires; on the other hand, some trees burn faster than others (younger trees are greener, so burn slower), and shrubs under a tree canopy can make fire more intense. A particularly rainy year can paradoxically increase fire risk if the rain comes in springtime, by boosting the volume of vegetation available to burn later in the season. Natural weather patterns like El Niño can have a dramatic effect on precipitation, and so on fire.

ALSO ON YALE E360

Scientists are getting far better at untangling the relationship between extreme weather and climate change. Read more.

> "If we have higher temps, we have a greater probability of fire starting, fire spreading, and fire intensifying."

Fire management is also a big contributor, leading to some surprising trends in the world's total burn area. Globally, wildfires actually decreased by about 7 percent over the first half of the 20th century,

probably due to increased efforts in places like the U.S. to stamp them out (though fires have gone up since the 1960s in the western U.S., the burned area there was actually just as bad in the early 1900s, before fire-fighting efforts kicked into high gear). The last half of the 20th century saw that global trend reverse, with the area burned bumping up by 10 percent, thanks in part to an increase of fires set in the tropics to clear land. The past 18 years saw burned area decline again, by nearly 25 percent, largely due to agriculture taking over fire-prone grasslands in areas like the African savanna.

All that makes it hard to pin down why any one given fire happened, or even why any one region might be seeing more fire, though a handful of such attribution studies have been done. Nevertheless, there is still a clear link between general climate trends — in particular warming temperatures — and an increased risk for fire. "If we have higher temps, we have a greater probability of fire starting, fire spreading, and fire intensifying. That's basic physics," says Stefan Doerr, a geographer at Swansea University in Wales and a chief editor of the *International Journal of Wildland Fire*. Warm air holds more water. So as air temperatures climb, the thirsty air sucks more moisture out of vegetation, making it better firewood. Warmer temperatures also lead to more lightning, which sparks some destructive wildfires — each degree of warming is thought to increase strikes by about 12 percent. Earlier snowmelts make fire seasons longer. And a warmer world is a windier world, bringing the potential to further fan flames.

British Columbia had more than 1,000 wildfires this summer, including this one in the Cariboo region. B.C. WILDFIRE SERVICE

Though climate change might also bring more rain to some areas, you need a lot of water to offset the impact of temperature: In Canada, one study shows, you need about 15 percent more rain to offset the increased fire risk from a 1-degree Celsius rise in heat. Climate models call for something on the order of a 10 percent increase in rain alongside 1 degree of warming in Canada — not enough to counteract the drying effect.

Last year, John Abatzoglou of the University of Idaho published a paper showing that human-caused warming since the 1970s has been responsible for about half of the increased dryness of western U.S. forests over the last 30 years. And the drier it was, the more forest burned. "It's a complicated issue," says Abatzoglou. "But the way we see it, how dry fuels are explains about three-quarters of year-to-year variability [in fires]." By the train of logic followed by Abatzoglou and his colleagues, climate change is to blame for doubling the area that burned in the western U.S. between 1984-2015, adding an extra 10 million acres of charred trees.

The Intergovernmental Panel on Climate Change's last report, in 2014, could only pin down strong evidence of major impacts on forest

fires due to climate change in three areas: Alaska, some parts of the Mediterranean, and eastern Africa. But that was a few years ago and, fire researchers argue, it was a conservative view even at the time.

The effects of warming temperatures on fire are being felt widely. Even Greenland has had a significant number of fires this year.

Today, researchers agree the effects of warming temperatures on fire are being felt widely. Even Greenland has had a significant number of fires this year, notes Flannigan, who ticks off the many areas where climate change is having, or will have, an impact: "Alaska and all boreal Canada is already seeing change, and it's going to continue. Western U.S., for sure. Southeastern U.S., maybe. Mediterranean, yes. Scandinavia, possibly. Sweden had a big fire in 2014 that really blew them away. Chile had the worse fire season on record by far. Australia, definitely. China, in the northern areas, yes."

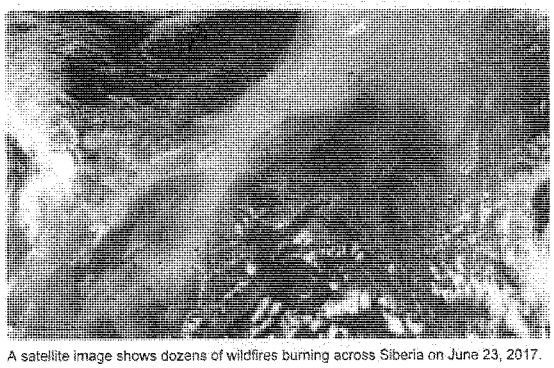
ALSO ON YALE E360

The northern forests of Alaska, Canada, and Siberia have emerged as the new global tinderbox. Read more.

Siberia is seeing its worst fires in 10,000 years, probably due to extreme temperature rises in that region. Interestingly, the new climate and all this fire looks set to change the types of trees growing in the Siberian landscape, to more fire-resistant species like deciduous conifer larch; researchers think fires there may actually level out.

Australia, which has had horrific wildfires in recent years, added a new category at the upper end of its fire risk scale in 2009: "catastrophic." But so far, scientists say, it is difficult to say if, or how much, climate change is responsible for that. The fire risk in Australia is very strongly affected by natural climate patterns like El Niño, and populations are moving into higher risk areas. "Human interaction is probably more important than climate change," says Doerr.

Nevertheless, climate change is expected to bring warmer, drier weather to some parts of Australia, extending the fire season and increasing the number of days where risk is particularly high.



A satellite image shows dozens of wildfires burning across Siberia on June 23, 2017.
NASA EARTH OBSERVATORY

While it's clear that a warmed world will likely be a more fiery one, the specifics are hard to pin down. In general, global climate models show a patchy map of future fire risk, with the areas of increased risk outweighing areas with a decreased chance of fire. The areas of increased hazard are scattered widely across the high latitudes, like Alaska, where changing climate tends to boost vegetation growth. Areas of decreased risk are mainly in the tropics, where rainforests, for example, might see more rain. One 2008 study predicted that the area burned across Alaska and Canada might increase 3.5–5.5 times over 1990 levels by 2100.

The increased risk for fires means we need to change how we manage them, argue Doerr and others. Since World War II, North America

has largely been focused on fighting a war on wildfire, military-style. In the U.S., a 2016 paper reports, aggressive fire suppression policies mean that only 0.4% of wildfires are allowed to burn; the rest are tackled by firefighters. But the strategy of putting out every fire only works when there are fewer fires, and when they happen in cooler, wetter years. Pumping ever-more money into firefighting tends to have only a small effect: one Canadian study showed that to meet a 15 percent increase in fire load, officials would have to more than double their firefighting budgets.

More fires mean more carbon dioxide emitted into the atmosphere and more smoke, with its attendant health problems.

One alternative is to allow more fire on the landscape, to eat up the excess fuel and fragment the forests into smaller burnable chunks. When you get more than 100 fires lit in a single day, as happened in British Columbia on July 7, there is no option but to do triage and assess which fires to attack and which to leave: "There was no way they had enough crews for them all, so they had to choose," says Flannigan. But that's what they should be doing all the time, he adds, using better models to predict fire growth and assess each fire's potential to harm valuable assets like watersheds and buildings. Flannigan is working to build artificial intelligence algorithms that can better predict the hot, dry, windy days that are particularly conducive to fire spread. "Allowing more fire on the landscape is good," says Flannigan, so long as there are the resources and warning systems to attack the threatening ones.

Other sensible options include restricting the type of vegetation planted near urban areas, and using prescribed burning and logging

to intentionally break up the landscape. But integrating all the different jurisdictions and companies involved with land management is a big task that's easier said than done, researchers note. The 1988 fire that burned half of Yellowstone National Park, Flannigan says, did a lot to help shift attitudes about fire from seeing it as evil to natural: Scientists used it as a springboard to talk about fire's healthy and rejuvenating effects on a landscape. But official policies did not change much, and there's still a long way to go in shifting opinions, he says.

Whatever actions are taken, in the face of climate change we will have to accept the idea of more fire in our lives. That means more carbon dioxide emitted into the atmosphere as trees and vegetation burn; more smoke, with its attendant health problems from pneumonia to heart disease; more fire retardant chemicals in our landscape and watersheds; more poisons like mercury spread from peatland and forest fires; and more black particulates darkening the planet's ice caps.

YALE E360 VIDEO

With warming, a terrifying new normal for firefighters. Watch here.

"We do expect to see more years like this one," warns Abatzoglou.

Nicola Jones is a freelance journalist based in Pemberton, British Columbia, just outside of Vancouver. With a background in chemistry and oceanography, she writes about the physical sciences, most often for the journal *Nature*. She has also contributed to *Scientific American*, *Globe and Mail*, and *New Scientist* and serves as the science journalist in residence at the University of British Columbia. MORE →

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November 9, 2017

Dr. John Bailey
Associate Professor
Oregon State University
College of Forestry
204 Peavy Hall
Corvallis, OR 97331

Dear Dr. Bailey:

Thank you for appearing before the Subcommittee on Environment on Wednesday, October 4, 2017, to testify at the hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions with a transmittal letter by the close of business on Thursday, November 23, 2017. Your responses should be mailed to Allie Bury, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, DC 20515 and e-mailed in Word format to Allie.Bury@mail.house.gov.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

John Shimkus
Chairman
Subcommittee on Environment

cc: The Honorable Paul Tonko, Ranking Member, Subcommittee on Environment

Attachment

Additional Questions for the Record

Dr. John D. Bailey, College of Forestry, Oregon State University

The Honorable John Shimkus

1) **Over the last three decades, the amount of timber harvested from federal lands has declined significantly while the number and extent of fires on these lands has increased significantly. Is this a coincidence or does thinning of forests actually reduce the risk of wildfires?**

Answer: It is not a coincidence that reduced removal of timber/fuel would be related directly to an increase in subsequent wildfires. Fuel accumulation is one side of the fire behavior triangle (with topography and weather), and we have more acres with high accumulations of fuels than ever in their evolutionary history, and those acres are more connected than they have ever been throughout much of the West. This accumulation issue is accented by recent climatic patterns that have created longer fire seasons and drier fuels, thereby increasing the probability of having ignitions that grow into large fires.

That said, not all timber harvesting practices reduce the accumulation of fine surface fuels that support most fire spread, so timber harvest alone, including thinning, without wise fuel management will not solve this problem. We need thoughtful, sustained, active management of our natural resources that view the hillsides as fuels – more than just timber or wildlife habitat, scenery, watersheds, recreational areas, or carbon. Our forests and associated landscapes are all these things, at the same time, and they are fuel ...and they will burn! With today's science, information and tools/technology, professional foresters can easily manage our landscapes sustainably to provide for all these things while minimizing the risk of wildfire losses. Prescribed fire and "wildland fire use" will be an integral part of that solution.

The Honorable Debbie Dingell

1) **Most recently, with the release of the Climate Science Special Report in August, scientists from 13 federal agencies all conclude and reaffirmed that we are feeling the effects of climate change right now. Forest fires were specifically addressed in this report and to quote the report directly: "The incidence of large forest fires in the western United States and Alaska has increased since the early 1980s and is projected to further increase in those regions as the climate warms with profound changes to certain ecosystems."**
a. Professor Bailey, do you agree with this assessment?

Answer: Yes

b. Professor Bailey, can you describe how climate change has exacerbated the prevalence and destruction of wildfires since the 1980s? And will more wildfires worsen the extent of climate change over time?

Answer: Like the first question, we can draw first and foremost on the physical reality that wildland fire is regulated by the interaction of fuels, topography and weather. The weather (climate) of the last three decades has clearly been warmer, and the National Interagency Fire Center has clear records about the beginning/ending of fire seasons for that time period, and therefore their total length. Fire seasons are now 30-60 days longer in much of the West relative to previous decades. This increases the length of time (weeks) during which ignitions can happen (lightning or humans) as well as the time intervals when they can grow quickly to sizes beyond which they can be contained. It also increases the number of days or weeks of severe fire weather conditions: high temperatures, low humidity, and high/gusty winds. Under these conditions, fires spread quickly and burn the crowns of trees as well as the ground surface, killing most or all of the vegetation, and doing the most damage to soil, water and habitat resources associated with our forests. A couple dozen additional large fires each year, each with a couple extra days of extreme fire behavior, results in some large landscape changes. Paired with the accumulation of fuel across western landscapes, this explains the large increase in the number of acres experiencing severe wildfire. There are individual case studies (actual wildfires) as well as modeling exercises that document and confirm this physical reality.

There is much less literature to my knowledge about the positive feedback between wildland fires and climate change, and it is all modeling exercises of some sort with ranges of input data and assumptions. Despite that, it is clear that "megafires" (those of tens of thousands of acres) return massive amounts of carbon quickly to the atmosphere that the weeks before had been sequestered on a hillside. Also, following severe wildfire, the residual dead carbon composed of standing and downed dead wood begins the long process of decomposing and returning to the atmosphere rather than being bound in living organisms. Both of those factors "add" carbon dioxide and methane to the atmosphere in the near term (decades) and could accelerate climate change. However, forests also sequester carbon as they grow and regrow following fire, such that light, low-severity surface fire releases only a small pulse of carbon to the atmosphere that is then quickly recaptured over the next year(s) by the surviving trees. Many of our western forests evolved with regular low- and mixed-severity fire, are adapted to such fire, and sequester and sustain the maximum amount of carbon under a fire regime with such frequent low-severity fire. This is because relatively small areas burn at high severity, avoiding the large amounts of carbon to the atmosphere for long periods. This difference in fire behavior therefore also speaks to the need for sustainable, active management of our nation's resources with acknowledgement that they are fuels, and that fire is part of their past, their present and their future – it is only a matter of when and how they will burn.

GREG WALDEN, OREGON
CHAIRMAN

FRANK PALLONE, JR., NEW JERSEY
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Minority (202) 225-3641

November 9, 2017

Mr. Jim Karels
Director, State Forester
Florida Forest Service
3125 Conner Boulevard
Tallahassee, FL 32399

Dear Mr. Karels:

Thank you for appearing before the Subcommittee on Environment on Wednesday, October 4, 2017, to testify at the hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

John Shimkus
Chairman
Subcommittee on Environment

cc: The Honorable Paul Tonko, Ranking Member, Subcommittee on Environment

Attachment

FLORIDA FOREST SERVICE
(850) 681-5800

THE CONNER BUILDING
3125 CONNER BOULEVARD
TALLAHASSEE, FLORIDA 32399-1650

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
COMMISSIONER ADAM H. PUTNAM

November 22, 2017

Ms. Allie Bury
Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515

(Via Email) Allie.Bury@mail.house.gov

Re: Responses to Questions for the Record on "Air Quality Impacts of Wildfires" Hearing

Ms. Bury:

My responses to your questions contained in your letter dated November 9, 2017 are attached.

It is my understanding these are Questions for the Record following the October 4 hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholder", for which I was a witness.

I appreciate the opportunity to testify at the hearing, as well as to provide the attached follow-up responses. Please feel free to reach out if you have any additional questions or information needs in the future.

Sincerely,

[redacted]

Jim Karels
State Forester

Attachments

November 22, 2017

Responses to Questions for the Record for Jim Karels, Florida State Forester

Hearing: Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders (Oct 4, 2017)

Questions from The Honorable John Shimkus

1. **Could you talk about your relationship as a Forestry agency with the regulatory environmental agency in Florida and how you carry out your state's prescribed burning program?**
   a. **How does your prescribed burning program fit within state regulations?**
   b. **How do prescribed burns help the environment?**
   c. **Do you believe the Clean Air Act would be more effective if it were to provide flexibility for the use of ecologically beneficial prescribed burns?**
   d. **Would any of the other witnesses care to comment on prescribed burns and air quality considerations?**

In Florida, the Florida Forest Service has statutory responsibility for the implementation of the state's outdoor burning program and works closely with the Florida Department of Environmental Protection's Division of Air Resource Management, who has air quality responsibilities. A long standing agreement between the two agencies has helped define roles and responsibilities of each agency and built a strong partnership that has been instrumental in the development of one of the most respected prescribed fire programs in the country. In addition to annual sit-down meetings with DEP Air, this year we also attended regional air quality meetings which included forestry and air agencies from States across the Southeast.

The Florida Forest Service and the Department of Environmental Protection worked together to develop Florida's first Smoke Management Plan which was approved by EPA in 1999. A revised Smoke Management Plan was approved again in 2014. Annually the Florida Forest Service issues on average about 85,000 open burn authorizations in Florida. Each authorization goes through a smoke screening process outlined in the Smoke Management Plan before it is approved.

Prescribed fire benefits the environment through two primary mechanisms. First, fire has a natural role in nearly all forest ecosystems, and prescribed fire allows for that role to be played under managed conditions. A healthy forest needs to maintain a regular fire return interval to thin out some of the trees to help the remaining ones grow, to provide wildlife habitat for species that have evolved under regular fire occurrence, and even to release a seed source for the next generation of tree growth.

Second, the use of prescribed fire reduces the likelihood of a catastrophic wildfire, and the environmental damage that would come with it, in the future. One of the keys to prescribed fire for hazardous fuels management is that it is done in seasons and under conditions where fire managers have the ability to control fire location, spread, intensity, and many other parameters.

Weather forecasting and state-of-the-art smoke modeling software allow for fire managers to tailor ignition locations and times to meet smoke management objectives. Fire managers work to manage a minimal amount of smoke now in avoidance of the potential for a much greater amount and the associated environmental and human health consequences in the future.

The use of prescribed fire is a necessity on the forested landscape, and the regulations around Clean Air Act implementation need to recognize this reality. The beneficial impact of managed prescribed fire on air quality emissions has been recognized by the US Environmental Protection Agency (EPA) in its Clean Air Act rulemaking over the past two years. In both the updating of the National Ambient Air Quality Standard (NAAQS) for PM 2.5 (81 CFR 164, pg. 58010) and the updating of the Exceptional Events Rule (81 CFR 191, pg. 68216), the EPA clearly documents the role of wildfire as an emissions source and the relevance of prescribed fire use and fuels management to reduce the risk of catastrophic wildfire. It is becoming increasingly evident through science and experience that without prescribed fire and the small amount of managed smoke that comes with it, we are perpetuating the conditions that generate catastrophic air quality issues and put communities and individuals at risk.

2. **In comments to the EPA on its proposed revisions to the Exceptional Events Rule, the Western States Air Resources Council (WESTAR) stated: "Ideally, EPA should work with state and federal fire-reporting agencies to develop a database of daily emissions for each significant wildfire. Such a database would provide states the opportunity to share updated emissions information and thus decrease the resources needed to develop exceptional event demonstrations."**
   a. **Is this reporting and collecting of emissions data happening?**
   b. **If not, should it be?**
   c. **In your opinion, what would be the impact on air quality if such a database were utilized?**

I am not aware of any efforts by the EPA to comprehensively collect and report the type of data described in this question. Currently, each state has its own burn program, and manages and tracks burn days and emissions from both prescribed and wildfire in different ways. These programs have been developed at the state-level based on state-specific ecological and social goals, and are locally successful due to that diversity. If the EPA were to develop a comprehensive nationwide database, it would be essential that it did not duplicate or increase workload for state agencies, or require program changes of states that eliminated successful state-specific attributes already in place. I agree that it would be a positive outcome to reduce the reporting burden for exceptional events, and to institutionalize at the EPA the recognition of fire emissions as exceptional events. If the process were streamlined such that more prescribed fires were allowed to be put on the landscape, I believe there would be a long-term benefit to air quality through reduced emissions from unplanned wildfire.

3. **Over the last three decades, the amount of timber harvested from federal lands has declined significantly while the number and extent of fires on these lands has increased significantly. Is this a coincidence or does thinning of forests actually reduce the risk of wildfire?**

There are a number of factors influencing the upturn in devastating wildfires on federal land, including increased development in the wildland urban interface (WUI), drought conditions, and insect and disease infestations, but certainly a lack of active forest management is among the most significant. There is clear and incontrovertible evidence that actively managed forests are significantly more resilient to the impacts of wildfire than those that receive no management. When fire sweeps through a managed forest, in many cases, it can have beneficial impacts. For example, in managed pine stands, fires burn the smaller trees and shrubs and prepare the ground for seed from the larger trees. In addition, protection of communities and firefighter safety is enhanced as these areas can provide safer areas from which firefighters can control oncoming wildfires. It is not a coincidence that reduced timber harvest leading to buildup of hazardous fuels has generated larger and more dangerous wildfires on federal lands.

GREG WALDEN, OREGON
CHAIRMAN

FRANK PALLONE, JR., NEW JERSEY
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November 9, 2017

Mr. Knox Marshall
Vice President of Resources
Murphy Company
2350 Prairie Road
Eugene, OR 97402

Dear Mr. Marshall:

Thank you for appearing before the Subcommittee on Environment on Wednesday, October 4, 2017, to testify at the hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

John Shimkus
Chairman
Subcommittee on Environment

cc: The Honorable Paul Tonko, Ranking Member, Subcommittee on Environment

Attachment

Murphy

2350 Prairie Rd. • Eugene, OR 97402 • 541.461.4545 PHONE • 541.461.4546 FAX

November 20, 2017

The Honorable John Shimkus
Chairman, Subcommittee on Environment
Committee on Energy and Commerce
2125 Rayburn House Office Building
Washington, DC 20515-6115

Chairman Shimkus:

Thank you for the opportunity to testify at the hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders" on Wednesday, October 4, 2017. Per your request, please find attached my response to your additional question for the record:

"Over the last three decades, the amount of timber harvested from federal lands has declined significantly while the number and extent of fires on these lands has increased significantly. Is this a coincidence or does thinning of forests actually reduce the risks of wildfires?"

Sincerely,

[redacted]

Knox Marshall
Vice President of Resources
Murphy Company

Enclosure:
Knox Marshall's Response for the Record

Committee Question for the Record:

Over the last three decades, the amount of timber harvested from federal lands has declined significantly while the number and extent of fires on these lands has increased significantly. Is this a coincidence or does thinning of forests actually reduce the risks of wildfires?

Knox Marshall's Response for the Record:

Over the past 10 years, an average of 6.8 million acres have burned from wildland fires annually.[1] During this period, an average of 202,000 acres have been harvested from National Forest System lands.[2] While the wildland fire acreage figures include both federal and non-federal lands, it is noteworthy that 34 times as many acres burned as were responsibly harvested from national forests. Policymakers and the American public can draw their own conclusions from this data, yet there is a wide body of scientific research suggesting the thinning of forests is effective in reducing the risks of wildfires.

In fact, according to the U.S. Forest Service's Fuels Treatment Effectiveness Database, 90 percent of fuels reduction projects- whether carried out through logging, thinning or prescribed fire- were effective in reducing wildfire severity.[3] Researchers from the University of Montana found that comprehensive treatment prescriptions designed to restore sustainable ecological conditions can move 90 percent of treated acres into a low-hazard condition.[4]

The Nature Conservancy and the U.S. Forest Service studied the economic benefit in taking proactive forest management activities, using the Mokelumne River watershed in the Sierra Nevada as a representative case. The research suggested that fuel treatments such as forest thinning and controlled burning can save up to three times the cost of future fires, reduce high-severity fire by up to 75 percent, and bring added benefits for people, water, and wildlife. In addition, by reducing the size and severity of fires, the carbon emissions from the fires were decreased by 38 to 77 percent, suggesting that these activities can help protect the carbon stocks sequestered in our forests.[5]

The National Insect and Disease Map, developed through rigorous scientific standards, indicates that 60 to 80 million acres of forests are at risk of insects and disease and are in need of treatment. In 2012, the Science-Based Risk Analysis Report determined that "experience with

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[1] National Interagency Fire Center, Statistics, National Fire News Year-to-Date Fires and Acres (nifc.gov)
[2] Harvest Trends on National Forest System Lands, Historic Harvest Records, 1984 to Present. Forest Service Activity Tracking System (FACTS)
[3] USFS, Adaptive Management Services Enterprise Team, Fuels Treatment Effectiveness Database (fs.fed.us/adaptivemanagement)
[4] C. Keegan, C. Fiedler, T. Morgan. Wildfire in Montana: Potential hazard reduction and economic effects of a strategic treatment program, Forest Products Journal, July/August 2004)
[5] Buckley, M., N. Beck, P. Bowden, M. E. Miller, B. Hill, C. Luce, W. J. Elliot, N. Enstice, K. Podolak, E. Winford, S. L. Smith, M. Bokach, M. Reichert, D. Edelson, and J. Gaither. 2014. "Mokelumne watershed avoided cost analysis: Why Sierra fuel treatments make economic sense." A report prepared for the Sierra Nevada Conservancy, The Nature Conservancy, and U.S. Department of Agriculture, Forest Service. Sierra Nevada Conservancy.

fuels treatment projects has demonstrated the value of fuels reduction to reduce wildfire suppression costs and protect land and resources."[6]

Dr. William Stewart, a University of California-Berkeley forestry specialist, writes that managing forests to reduce fuel loads "provides immediate dividends," "including fewer fuels mean less-intense wildfire, greater firefighter safety, lesser environmental consequence and fewer greenhouse gas emissions."[7] I agree with Dr. Stewart's assessment, and I urge the United States Congress to take action to increase that pace and scale of thinning and other forest management activities on federal lands.

Once again, thank you for the opportunity to testify before the Subcommittee on Environment and to address your additional question for the record.

[6] 2013-2027 National Insect and Disease Forest Risk Assessment, Forest Health Technology Enterprise Team, U.S. Forest Service, January 2014

[7] Stewart, W, *The Multiple Benefits of Managed Forests*, University of California-Berkeley, Center For Forestry. , California Forests, Summer 2010

GREG WALDEN, OREGON
CHAIRMAN

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November 9, 2017

Dr. Christopher Topik
Director, Restoring America's Forests
The Nature Conservancy
4245 N. Fairfax Drive
Arlington, VA 22203

Dear Dr. Topik:

Thank you for appearing before the Subcommittee on Environment on Wednesday, October 4, 2017, to testify at the hearing entitled "Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders."

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Sincerely,

John Shimkus
Chairman
Subcommittee on Environment

cc: The Honorable Paul Tonko, Ranking Member, Subcommittee on Environment

Attachment

Christopher Topik, The Nature Conservancy
Answers to Additional Questions for the Record

House Committee on Energy and Commerce,
Subcommittee on Environment
Hearing Wednesday, October 4, 2017, entitled:
"Air Quality Impacts of Wildfires: Perspectives of Key Stakeholders."

The Honorable Frank Pallone, Jr.:

1. Forest ecosystems are at risk due to a number of factors including the changes in climate. As you and other witnesses pointed out at the hearing, controlled burns should be part of a management plan for forests, and gaining support for this management practice with managers and the public has been challenging in many areas of the country. In general, there is public support for maintaining healthy, resilient forests over the long term. However, short-term priorities general dominate budgets and management practices. What are some options to incentivize federal, state, and local forest managers to prioritize long-term goals for fire management or at least weigh them equally with the need to address immediate needs?

Topik Answer:

I think that it is essential that we do an honest job of assessing our national, state and local funding and staffing to implement all three major goals of the nationally accepted National Cohesive Wildland Fire Management Strategy. As I discussed in my written testimony, the nation has done a pretty good job of coming up with a plan, largely based in science, but we are not doing a good job of building capacity, both human resources and funding for the up-front mitigation, forest and fire management activities, including maintenance that we know will provide for long-term forest health and reduced catastrophic fires. We can't stop fires from being damaging, but we can get our citizens, communities and natural resources much more fire ready and understand that fire is also a natural forest process in many cases. To date the Congress and most states have been focused on dealing with the immediate emergency needs of fire suppression and have under resourced the known approaches to improve fire adapted landscapes and communities.

1. Helping communities and citizens to be fire adapted:

As briefly discussed in my statement, there are some proven programs that are already showing cost-effective approaches to organize and improve community readiness to fire. This means being ready before, during and after fire. These

approaches are not expensive, but they are underfunded and usually get left behind when government and the Congress are stressed to fund immediate fire suppression needs. Increasing funding for such programs, like the Fire Adapted Communities learning network, the U. S. Fire Learning Network, the Collaborative Forest Landscape Restoration Program and the Joint Chiefs Landscape Restoration Partnership would provide direct benefits to increase citizen action, enhance collaboration and cost sharing with a wider array of local governments and industries, and reduce the negative effects of severe wildfires.

A large part of this action is working collaboratively with communities and public health officials and providers to understand the need for various kinds of controlled burning and fire use, managing the short term adverse impacts of controlled smoke events in order to avoid the really nasty, prolonged impact of uncontrolled wildfires that we saw this year in particular. Communities that have accepted their shared risk of wildfires and made local investments to become fire-ready provide public land managers and fire services with the enabling conditions and support (i.e., incentive) to make longer-term decisions about how they manage fire.

We also need to establish and implement organized adaptive management processes that can monitor and evaluate what specific programs are most effective and what impacts they have on overall fire management effectiveness and costs.

2. Increase resilience of fire adapted landscapes

There is a great deal known about methods that can increase the resistance and resilience of landscapes, especially forests, to fire. More science is certainly needed to directly evaluate ecosystem responses and treatment effectiveness, but we are not even utilizing the knowledge we already have. Much of the most problematic wildfire impact is in fire-prone landscapes that now are out of whack due to a variety of past management practices and a changing climate. This means that we need to dramatically increase our ability to bring fire use and controlled burns back, including the use of managed wildfires when and where it can be done safely. In the long run, I don't see any approach to achieving success on our vast areas of fire prone landscapes without such implementation. Logging and vegetation removal alone will not do it, although this is often an important part of the process of bringing forests back to a healthier condition that will resist extreme damage.

The policy choice is pretty clear: do we have the political will to invest in proven up-front mitigation and maintenance management techniques that reduce negative impacts subsequently? And can we monitor, adapt and determine the other co-benefits of these treatments, such as cleaner water, continuation of business and tourism activities, forest product harvest, and fish and wildlife use and enjoyment? Adding some honest economic and social calculations, and then following the

evidence, would lead to a much better use of our federal and state resources and staffing.

The Honorable Debbie Dingell:

1. The President recently announced the United States will be withdrawing from the Paris Climate Accord, announcing to the world that the U.S. federal government is abandoning its commitment to tackle climate change. Essentially saying that our rapidly changing climate isn't worth addressing.

    a. Mr. Topik, in your testimony you mention the need for increased long-term protection of forest resources from threats like catastrophic wildfire, insects, and diseases. Can we realistically achieve the goal of maintaining healthy and resilient forests without acknowledging the threat posed by unchecked warming?

2. By all reports we are in the middle of the most expensive wildfire season to date, with over $2 billion spend this year combating fires according to the U.S. Forest Service.

    a. Mr. Topik, if we fail to properly address climate change now, in your best estimate, will combating and preventing wildfires be more or less expensive in the future?

3. In 2016, according to the Michigan Department of Natural Resources, there were 262 reportable fires that occurred on over 3,000 acres in Michigan. The Forest Resources Division responded to a total of 384 fires. In comparison to western states, this is a low number of wildfire events.

    a. Mr. Topik, if we do nothing to address climate change could wildfires spread or increase in non-western states, including Michigan?

Topik Answers:

1. It is unlikely that we will be able to develop and implement forestry and integrated fire management in the future without careful analysis of the changes that climate change has already made and will certainly increase in the coming decades. All responsible scientists and industry already recognize that large changes have occurred, with the fire seasons now being longer in most all forest types in North America and globally. Forestry and integrated fire management is a long term endeavor, so caring for forests requires a perspective that looks ahead for many decades. Unchecked global warming will change the balance of environments that forests and communities face and will certainly also increase the extreme weather events that can be the most damaging to people and nature. If society does not respond to current climate threats, the increasing global climates will unsettle the forests and exacerbate the context for severe fire that we currently have, and require

much more human intervention to provide the vital services, such as our water, wood and wildlife, that we need.

Fortunately, forested landscapes are also one of the greatest natural solutions to reduce future climate change. It is vital that society and governments and industry invest in proven greenhouse gas reducing management, including extensive reforestation, improved forest management, avoided conversion of forests to non-forest, and improved fire management so forests are not lost in the future due to catastrophic fires and vegetation change. The recent scientific report by Nature Conservancy scientists and partners shows how various activities, including aspects of forestry and fire management, can play a major part in mitigating future climate change, if we invest. This paper details 20 specific pathways for action – what we call natural climate solutions– and finds that they can cost-effectively deliver 37% of the emissions reductions the world needs by 2030.
(see Proceedings of the National Academy of Sciences, Oct. 31, 2017, vol. 114 no. 44, B. W. Griscom, et. al, 11645–11650, doi: 10.1073/pnas.1710465114)

2. A future with unabated climate change will also include much more extreme and costly damage to communities and habitats. The combination of expanding populations into fire prone areas and more extreme weather events that trigger catastrophic fires will certainly lead to vastly increased costs of fire suppression and costs to society with mortality events and damage to watersheds. The kinds of tragic fire events we have seen this year in Northern California and last fall in Tennessee will be more common. The future costs of severe fire events in a changed climate world will be large in monetary treasure, but larger in human impacts and lost opportunities.

3. Yes, current projections for the US indicate greater wildfires in more areas. The specific locales of future wildfire events are not knowable everywhere, but it is known that climate change will bring with it greater vacillation in extreme weather events. It is just these kinds of extreme events that can bring unexpected and unanticipated wildfires to areas that previously have not had such recent experiences. That means it is likely that Michigan and other non-western states may find themselves facing surprising wildfires more often.

   From a worldwide perspective, warming in the boreal and Arctic region is projected to be substantially above the global average, a trend consistent with both model projections and observations. According to the Intergovernmental Panel on Climate Change (IPCC), in the past 100 years temperatures in the Arctic have increased at twice the global rate. Boreal forests are expected to be especially sensitive and vulnerable to climate change because those ecosystems are naturally sensitive to warming, because of the nature of their soils (peat and permafrost are prevalent) and the likelihood of increased incidence and extent of fire. Additionally, boreal forests themselves have the ability to impact the global climate through radiation balance and carbon cycling, leading to interconnected feedback loops between climate and forest. i.e. boreal forests are expected to be more problematic for severe fires under the projected climate change scenarios.

The recent tragic, fire caused mortalities in the southern Appalachians and the frequent tragedies in Texas, Kansas and Oklahoma may well be harbingers of future problems in places that we don't think of as having fire problems but are in fact naturally fire adapted forests and rangelands. This includes areas such as New York, New Jersey and the broader Appalachians, as well as the northern forests of Great Plains and Midwestern states. It's not just drought that brings on fire events, but the combination of increased human infrastructure, inadequate preparation, rainy periods that enhance vegetative fuel growth, and extreme, dry windy events.

Furthermore, non-western areas are greatly impacted indirectly by the costs and business interruption that severe western wildfires bring to our entire nation.

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