WILDFIRES AND THE CLIMATE CRISIS

HEARING

BEFORE THE

SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING HOUSE OF REPRESENTATIVES

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WILDFIRES AND THE CLIMATE CRISIS

THURSDAY, NOVEMBER 1, 2007

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON ENERGY INDEPENDENCE
AND GLOBAL WARMING,
Washington, DC.

The committee met, pursuant to call, at 10:06 a.m. in Room 2172, Rayburn House Office Building, Hon. Edward J. Markey [chairman of the committee] presiding.

Present: Representatives Markey, Blumenauer, Inslee, Solis, Sandlin, Cleaver, Hall, McNerney, Sensenbrenner, Walden, Miller, Blackburn.

Staff present: Ana Unrun-Cohen, Stephanie Herring, Morgan Gray and Joel Beauvais.

The CHAIRMAN. Good morning. This hearing is called to order. And we thank everyone for their participation. Our prayers and support go out to the people of southern California who have suffered so much in the recent deadly fires and are bracing for more this weekend, according to the latest forecasts. Last week's 22 fires displaced a half million people and caused at least $1.5 billion in damages. Not since Hurricane Katrina slammed the Mississippi and Louisiana coasts have so many suffered from extreme weather.

At least one of the smaller fires appears to have been caused by a young boy playing with matches. And California is rightly concerned with sorting out what started with arson from what started with lightning or power line collapse or other common causes of such fires. That is not what this hearing is about.

Global warming does not cause an individual fire or hurricane, and global warming is not the cause of the California fires. Global warming's contribution to wildfires is more subtle and more complex, and scientists and the fire fighting community are just beginning to tease out of this complex climate record those factors which may be influencing these natural disasters in unnatural ways. In fact, the impact of global warming on the West is more evident in places other than southern California where drought and fire appear to have been commonplace in the undisturbed ecosystem.

There is no doubt that a century of stifling the natural fire regime of western forests and the increasing numbers of people living in fire-prone areas has made the impact of wildfires worse. The questions before us today are, how will wildfires change in a warming world? And what can we do to reduce their impact? We can learn something about a warmer future by looking at the recent past. As temperatures have risen in the West, the frequency, intensity and area burned by wildfires has increased.

Recent scientific studies have found that, since 1986, the western fire season is 78 days longer. There has been a fourfold increase in fires larger than 1,000 acres. There has been a sixfold increase in areas and acres burned. And over the last century, fire has increased to the point where the projections for the next century is that fire will probably burn two or three times as much land in the West as it does today. Some of the most dramatic increases in fire frequency and intensity are occurring in higher elevations where fire suppression has not historically been used, underscoring the influence of global warming rather than past forest policies on wildfires.

Global warming influences wildfires in a variety of ways, through increased drought and reduced rainfall, earlier spring snow melt and better breeding conditions for insect infestations. These factors combine to create a longer and more extreme dry season, resulting in tinder box conditions ripe for ignition. It appears that global warming is stacking the wildfire deck, making it more likely that when an errant spark flies, we will be dealt a losing hand. And losing to mother nature can be expensive.

As we learned in one of our first hearings, damages from extreme weather alone have likely cost our Nation $800 billion since the 1980s. In addition to property losses, fires increasingly eat up the Forest Service budget, as they have to spend more and more to fight them. In 2006, it spent a record $2.5 billion just for fighting wildfires.

Data points and dollar signs aren't the only measure of the changing nature of fires in the West. The men and women on the fire line have experienced the impact of warming temperatures firsthand. Tom Boatner, a 30-year fire fighting veteran and chief of fire operations for the Federal Government said in a recent interview, "we have had climate change beat us over and over the last 10 or 15 years. We know what we are seeing."

What can Congress do to help cope with this increasing threat? Policies that improve forest management on the edge of communities and help make these communities more resilient are crucial but not comprehensive. We will ultimately reach the limit of our adaptive capacity, which is why we must act now to begin to address the underlying disease of global warming, not just the symptoms.

Congress has the opportunity to send an energy bill to the President that could by 2030 reduce U.S. global warming pollution by up to 40 percent of what we must do to save the planet. This will lay the foundation for achieving more significant cuts through a subsequent cap, auction and trade bill. We have already set in motion changes to our western forests. Now we must adopt smart policies that will help avoid the unmanageable and manage the unavoidable impacts of global warming. And now I would like to turn to recognize the ranking member of the Select Committee on Global Warming, the gentleman from Wisconsin, Mr. Sensenbrenner.

[The prepared statement of Mr. Markey follows:]

Opening Statement for Edward J. Markey (D-MA)
"Wildfires and the Climate Crisis"
Select Committee on Energy Independence and Global Warming
November 1, 2007

This hearing is called to order.

Our prayers and support go out to the people of Southern California who have suffered so much in the recent deadly fires and are bracing for more this weekend given the latest forecasts.

Last week's 22 fires displaced a half a million people and caused at least $1.5 billion in damages. Not since Hurricane Katrina slammed the Louisiana and Mississippi coasts have so many suffered from extreme weather. At least one of the smaller fires appears to have been caused by a 6 year old playing with matches, and California is rightly concerned with sorting out what started with arson from what started with lightning or powerline collapse or other common causes of such fires.

That is not what this hearing is about. Global warming does not cause an individual fire or hurricane, and global warming is not the cause of the California fires.

Global warming's contribution to wildfires is more subtle and more complex, and scientists and the firefighting community are just beginning to tease out of this complex climate record those factors which may be influencing these natural disasters in unnatural ways. In fact the impact of global warming on the West is more evident in places other than Southern California, where drought and fire appear to have been commonplace in the undisturbed ecosystem.

There is no doubt that a century of stifling the natural fire regime of western forests and the increasing numbers of people living in fire prone areas has made the impact of wildfires worse. The questions before us today are how will wildfires change in a warming world and what can we do to reduce their impact.

We can learn something about a warmer future by looking at the recent past. As temperatures have risen in the West, the frequency, intensity, and area burned by wildfires has increased. Recent scientific studies have found that since 1986:

- Western fire season is 78 days longer;
- There has been a 4 fold increase in fires larger than 1000 acres;
- There has been a 6 fold increase in acres burned; and
- Over the next century, fire will probably burn two or three times as much land in the West as it does today.

Some of the most dramatic increases in fire frequency and intensity are occurring in higher elevations where fire suppression has not historically been used – underscoring the influence of global warming, rather than past forest policies, on wildfires.

Global warming influences wildfires in a variety of ways – through increased drought and reduced rainfall, earlier spring snowmelt, and better breeding conditions for insects infestations. These factors combine to create a longer and more extreme dry season, resulting in tinder box conditions ripe for ignition. It appears that global warming is stacking the wildfire deck, making it more likely that when an errant spark flies, we will be dealt a losing hand.

And losing to Mother Nature can be expensive. As we learned in one of our first hearings, damages from extreme weather alone have likely cost our nation $800 billion dollars since the 1980s. In addition to property losses, fires increasingly eats up the Forest Service's budget as they have to spend more and more to fight them. In 2006, it spent a record $2.5 billion just for fighting wildfires.

Data points and dollar signs aren't the only measures of the changing nature of fires in the West. The men and women on the fire line have experienced the impact of warming temperatures first hand. Tom Boatner, a 30 year firefighting veteran and the Chief of Fire Operations for the federal government, said in a recent interview, "We've had climate change beat into us over the last ten or fifteen years. We know what we're seeing."

What can Congress do to help cope with this increasing threat? Policies that improve forest management on the edge of communities and help make these communities more resilient are crucial, but not comprehensive. We will ultimately reach the limit of our adaptive capacity – which is why we must act now to begin to address the underlying disease of global warming, not just the symptoms.

Congress has the opportunity to send an energy bill to the President that could, by 2030, reduce U.S. global warming pollution by up to 40 percent of what we must do to save the planet. This will lay the foundation for achieving more significant cuts through a subsequent cap-auction-and-trade bill. We have already set in motion changes to our western forests. Now we must adopt smart polices that will help avoid the unmanageable and manage the unavoidable impacts of global warming.

And now I would like to recognize the Ranking Member of the Select Committee, the gentleman from Wisconsin, Mr. Sensenbrenner.

Mr. SENSENBRENNER. Thank you very much, Mr. Chairman. Like all natural disasters, the recent wildfires in southern California have taken an enormous toll on lives and property damage. With 7 dead, 2,000 homes destroyed, 640,000 people displaced and possibly up to $2 billion in damages, wildfires have again shown that they are a deadly threat to people living in the arid West, just as hurricanes have proven to be a deadly and destructive threat to people living on the Atlantic and gulf coasts.

Death and destruction aren't the only things that wildfires and hurricanes share in common. They are now both used as poster children for global warming. I am glad the Chairman has said that global warming didn't cause the wildfires, unlike the comments made by the Senate Majority Leader over in the other body a couple of weeks ago. While both of these severe weather events are common and occur naturally, global warming alarmists are using these natural disasters to promote regulations that will have little or no effect on the forces of nature.

In regards to global warming, there are many similarities between hurricanes and wildfires. In both cases, they are complicated natural events, influenced by a variety of factors. And yes, in both cases, warmer temperatures can create conditions that would amplify the effects of these disasters. But just like hurricanes, there is no concrete scientific link between the southern California wildfires and global warming. And even if there were, Members of Congress would be fooling themselves to think that by passing a bill to supposedly do something about global warming, they would have any measurable impact on the ground in southern California.

What would have a measurable impact in California and in other parts of the country are smart forestry practices. Liberal environmentalists have long fought to prevent management of our forestry, which exacerbates many problems that make forest fires worse. By allowing forests to go unmanaged, it allows for grasses, underbrush, dead trees and other growth to serve as kindling for these fires.

As the wildfires were raging last week, the Los Angeles Times reported that forest thinning helped the resort town of Lake Arrowhead to avoid the worst of the damage. The Times described the area as, quote, an island in a sea of destruction, unquote. By creating what are known as fuel breaks, residents of Lake Arrowhead were able to see firsthand the effect of forest thinning as they watched billowing fires stop nearly dead in their tracks. Forest thinning produces a tangible measurable environmental benefit. I wouldn't support any global warming legislation that doesn't result in measurable environmental damages.

There is another similarity between hurricanes and wildfires that Dr. Steven Running points out in his testimony today. Just like the hurricanes, the damage suffered by wildfires is often the result of where you live. Live by the ocean, and the chances of your house getting knocked down by a hurricane are much greater than those more inland. The same is true of those who build in the wild land urban interface where the dangers of wildfires are greatest.

As the fires raged, the Los Angeles Times also posed the question of whether global warming was part of the problem. The answer appears to be a qualified, no. Quoting the Journal of Science, the

Times reported that, unlike the rest of the West, there has been no increase in the wildfire frequency in southern California. Pointing out the potential problems of global warming is easy. What would also be easy is preparing for natural disasters through adaptive management techniques, like forest thinning and fuel breaks for wild land fires. The hard part is finding ways to promote the development of energy sources that don't emit CO_2 and other greenhouse gases. If we can do this, we would truly be doing something about global warming. I thank the Chair and yield back the balance of my time.

The CHAIRMAN. The gentleman's time has expired.

The Chair recognizes the gentleman from Oregon, Mr. Blumenauer.

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

I agree with my distinguished friend from Wisconsin about the concerns of development. In fact, I talked about that to one of the L.A. Times reporters. We kind of joked, I have this conversation with him about every year when these fires break out, and we don't do anything about the problem with that interface. In fact, we have so created a problem that it is hard to characterize these as natural disasters because we make them more likely. We make them worse, and we allow more and more and more people to be in the flame zone.

Global warming puts this in perspective where we are not going to be able to ignore it any longer. And any amount of intelligent forestry is not going to save us if we continue to have more development. Two-thirds of the new buildings in southern California over the past decade were on lands susceptible to wildfires. If last week's fires had burned in the same location in 1980, there would have been 61,000 homes. By 2000, that number had risen to 106,000, and by this year, it was 125,000. Now we have got to get our heads around the fact that we are having a situation that we are making worse; it is compounded by global warming.

And the Federal Government is actually producing malpractice. We are lavishing money on fighting fires. We are not spending money on disaster protection to make them less likely. We save $4 for each $1 we put in prevention. And we keep putting people back in harm's way. We subsidize development. We don't have reasonable regulation, and then we bemoan the fact that we have these wildfires, and we call them natural disasters. I think that is abuse of the term. It is not fair to nature. I look forward to hearing from our witnesses today to sort of deal with the big picture. Because if we continue to have more and more people located in the flame zone, the fastest growing States are areas that are subjected to persistent drought, subjected to wildfire, and of course, we are going to have the floods. When the rain finally does come in southern California, then we are going to be paying a lot of money to help people with mudslides and calling it an act of nature.

I really appreciate this hearing. I hope we can continue to look at this through the prism of global warming because I think it is going to up the ante, and maybe finally Congress will stop practicing malpractice when it deals with these disasters.

[The prepared statement of Mr. Blumenauer follows:]

Representative Earl Blumenauer
Statement for the Record

"Wildfires and the Climate Crisis"
November 1, 2007

These days wildfires are hard to characterize as "natural disasters," as we are the ones that make them more likely and worse.

I watched the news about the California wildfires with a sense of déjà vu. Even without global warming, the areas that burned are areas that have burned before and we can expect to burn in the future. Global warming will up the ante.

Global warming will force us to look differently at development and prevention. Two-thirds of the new building in Southern California over the past decade was on land susceptible to wildfires. In San Diego Country, three out of four homes built since 1990 are in the dangerous flame zone where open spaces and housing meet. Development and sprawl have not really been part of the discussion in the past, but global warming forces recognition that more people and property in hazardous areas has increased the overall cost and damage done by fires.

Unfortunately, the Federal government has encouraged this development through federally financed infrastructure, efforts to provide urban level fire protection in the middle of the woods, and unconditional disaster relief.

There are few disincentives to move into high-risk areas: until recently, insurance companies rarely considered the risk of wildfires in premium calculations, few localities restrict development or require home protections such as sprinkler systems and fire resistant building materials, and homeowners assume that the federal government will protect their homes.

All of this development is not only putting people at risk, but it's increasing the cost of fires. Already fire fighting costs make up almost half of the Forest Service's budget. Fires in developed areas are exponentially more expensive to fight than those without. For example, in 2000, a 600-acre fire in Montana's Jedidiah Smith Wilderness Area cost approximately $22,000. In contrast, a 250-acre fire near the town of Wilson, WY cost $350,000. Had last week's fires burned in the same locations in 1980, about 61,000 homes would have been within a mile of a fire. By 2000, the number would have grown to 106,000 homes, and this year it was 125,000, according to an analysis by the University of Wisconsin.

Between global warming and increased development in hazardous areas, this situation is going to get worse. No amount of "smart forestry" will save us from global warming and ourselves. We know there are ways to help communities reduce their risks. How and where people build can make a big difference. Communities can take steps to limit new development in high risk areas. Building codes that require fire resistant building

materials, home sprinkler systems, and "defensible space" landscaping can protect homes. For example, during the recent fires, some homes were made so safe that they were considered "shelter-in-place" communities. In short, I believe it makes more sense to "fire proof" communities, rather than "fire proof" forests.

We also know that it's much less expensive to prevent damage than to provide disaster relief. A recent study commissioned by FEMA showed that $1 spent on mitigation saved $4 on disaster relief after the fact. We saw during the fires last week that communities that had spent time and money fire proofing were spared much of the damage. And yet Congressional budget rules treat disaster relief as "free money," outside of the scope of federal budgeting rules, while prevention measures have to go through the appropriations process and compete with other priorities.

Thinning and fuels reduction projects that are done as cooperative efforts between the timber industry and the conservation community, such as what is happening more and more frequently in Oregon, can also make a big difference.

I greatly appreciate the attention paid to this issue by our panelists, and I look forward to exploring with you how the Federal government can be a better partner to encourage communities to take steps to reduce their vulnerability to fires.

The CHAIRMAN. The gentleman's time has expired.

The Chair recognizes the gentleman from Oregon, Mr. Walden.

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

I appreciated your comments in the opening statement, vis-a-vis the problems we have in our national forests, and some of us have actually been trying to working to change those policies, and I look forward to working with you in those endeavors. I frankly think the passage of the Healthy Forest Restoration Act, which I know not everyone on this committee supported, provided for the wildfire community planning process to allow the communities to come together and deal with the wild land urban interface, and it has been quite successful where it has been implemented in communities across America and has really resulted in fuel reductions and better planning processes, and that is what is needed. But the bigger problem really rests on the state of America's national forests. Teddy Roosevelt would be rolling over in his grave right now if he could see what has happened to his great forest reserves, which he called for active management upon.

Right now, the 192 million acres in the national forest system, 52 million acres are at risk to catastrophic wildfire. Wildfire like this depicted behind me is the Egley fire, burned this summer out in central Oregon; 140,000 acres burned. This did not come about because of homes there. This came about because of a lightning strike, and it burned over a prior burn; 140,000 acres were consumed. These children standing here are the future. Caleb Presley 10; Ashley Presley, 6. They are the grandkids of the Harney County Judge Steve Grasty. This is the future forests that we are giving them because of inaction, because of failed practices in the past, because of litigation, because we lock it up, leave it, and let it burn, and do nothing about it.

Now some of us on this committee, my colleague Ms. Herseth and I worked together on the Forest Emergency Recovery and Research Act, which passed overwhelmingly in the House, the bipartisan bill to go in after these fires, remove the dead burned trees where it makes sense environmentally and where we can still get value out of the timber. Because we are going to use wood in America, we ought to use the burned dead wood, not import illegally harvested wood from across the globe, which is what we are doing today in America. We are using that wood, harvested illegally in furniture we buy back here.

So changes have to occur if we are going to deal with carbon emissions, if we are going to make our forests healthier, if we are going to keep up with the increasing temperatures that are occurring. And the Forest Service tells us that is what is happening. Then forests in the West—especially the eastern side, my district certainly has got to be managed better if we are going to keep pace and have the appropriate fire regimes. And at some point, I will get into the IPCC language because I think it makes the case as well.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. The gentleman's time has expired.

The Chair recognizes the gentlelady from South Dakota, Ms. Herseth Sandlin.

Ms. HERSETH SANDLIN. Thank you, Mr. Chairman. I will forgo an opening statement to add additional time to my questioning. Thank you.

The CHAIRMAN. The Chair recognizes the gentleman from New York State, Mr. Hall, for an opening statement.

Mr. HALL. Thank you, Mr. Chairman.

I also will save my time for questions.

The CHAIRMAN. The gentleman's time is reserved.

The Chair recognizes the gentlelady from California, Ms. Solis.

Ms. SOLIS. Thank you, Mr. Chairman.

I am pleased that you are having this hearing today because I also represent California, southern California. And I am very pleased that we did not suffer this time around the enormous fires that surrounded Los Angeles County. Yesterday we heard from some folks that came by to talk to our California Delegation about how we could better manage this particular rising crisis that continues to plague areas like southern California. And one that I would be interested in hearing from our witnesses is, what we need to do to help provide more assistance to our State forest, you know, wild service; what plan, management that we need, the tools that we need. I understand that the Bush Administration has cut back by 18 percent on funding for the management plans that our States should have in place. So I am very concerned. I want to hear about that. I am very interested also in how we can help distressed communities, low-income communities so that they have fully implemented evacuation plans and that they, too, understand the importance of security and understand that they are also a part of the solution and would like to hear more about that.

I have had the privilege of being on C–SPAN just a couple minutes ago. And many people do not understand what is happening to our climate change that is occurring and the impacts. And I understand that some people will say, there is no correlation between the fires and global warming. But we do see in southern California and other arid areas in the southwest where we have experienced drought-like conditions for the past 7 and 6 years. And we continue to not focus on that and do preparation for these disastrous fires. So I think that it is a combination of different things, both planning the forests, better resources and better management at the local level and coordination with the State and Federal level and, of course, the funding to implement that I think are very important. That is all I want to say, and I look forward to hearing from the witnesses. Thank you.

The CHAIRMAN. The gentlelady's time has expired.

The Chair recognizes the gentlelady from Michigan, Mrs. Miller.

Mrs. MILLER. Thank you, Mr. Chairman. And I certainly want to thank you for holding this hearing today. Certainly what has happened in southern California is of utmost interest certainly to our entire nation, to the entire world quite frankly. And if it is not inappropriate, I might just take 1 minute to formally put myself on the record to ask you to consider a hearing for a different topic at another time, and that is regarding the Great Lakes. We have historic low lake levels. I will just take one quick minute. Unbelievably low lake levels that is happening in the Great Lakes, which is one-fifth, 20 percent, of the fresh water supply of the entire plan-

et, much of it can be attributable I think to climate change, changing weather patterns. Some of it is man-made but it is having an unbelievable negative impact on many segments of society. And I know we are going to talk about wildfires today. But I would like to be on record asking you to consider such a hearing in the future. Thank you.

The CHAIRMAN. Absolutely we will. In part I am responding in this hearing to the request from Mr. Walden and Mr. Blumenauer that we spend more time on the forestry related issues, and I will try my best to accommodate that request as well. Let me now turn and recognize the gentleman from California, Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman.

My heart certainly goes out to the families who lost their homes in last week's fire. Whether it is fires, hurricanes, earthquakes, any of these human tragedies are something that we feel deeply about and that we want to try to avoid as much as possible. Are these large fires the result of global warming? Well, we can't really answer that definitively; can we? Certainly the fires, the droughts, the large frequent storms are consistent with the theory of global warming. We will indeed see more of these large fires. We will see more hurricanes. We will see droughts. And it is incumbent upon us to understand what is going on here, to adapt and to mitigate, and I think that this hearing is a good step in that direction. I thank the panelists for coming today, and I look forward to your testimony. Thank you. I reserve the balance of my time.

The CHAIRMAN. The gentleman's time has expired.

And I don't see any other members seeking recognition.

[The prepared statements of Mr. Cleaver and Ms. Blackburn follow:]

U.S. Representative Emanuel Cleaver, II
5th District, Missouri
Statement for the Record
House Select Committee on Energy Independence and Global Warming Hearing
"Wildfires and the Climate Crisis"
Thursday, November 1, 2007

Chairman Markey, Ranking Member Sensenbrenner, other Members of the Select Committee, good morning. I would like to welcome our distinguished panel of experts to the hearing today.

The incredible destruction caused by the massive wildfires in California this season has captured the attention of all Americans, especially those who have been directly affected by the disaster. The wildfires have caused at least $1 billion in damage to the area, though that number is expected to rise significantly. While the fires themselves cannot be ignored, their cause is something that we must better understand if we are to possibly avoid more wildfires in the future. Scientific evidence supports the claim that the effects of global warming include longer and warmer summers, and increasingly variable weather in general. Drought conditions, at least intensified by global warming, have been deemed to have increased the possibility of wildfires due to drier and more flammable plant life.

Americans should not have to live in fear for the wellbeing of their lives and property because of the increasing threat of wildfires. Congress must do what it can to protect the American people from natural disasters that may be intensified by human action. Because global warming has been directly linked to greenhouse gas emissions, a change in environmental regulation is essential to protecting Americans and those around the world from serious consequences like wildfires.

I thank the panel for their insight and their suggestions concerning the connection between wildfires and global warming as Congress moves ahead with a new national energy and environmental policy.

Thank you.

Opening Statement for Marsha Blackburn (R-TN)

Mr. Chairman:

I want to thank you for holding this hearing, and I want to thank the witnesses for taking their time to come and testify before this committee.

Today, we will examine whether climate change may play a contributing factor in the recent trend of wildfires.

Mr. Chairman, most available evidence from scientific studies suggest that global warming has played little to no role in these wildfires.

We all know that global temperature has only increased by 1 degree over the last century.

And this change is too small to drastically change wildfire frequency, size, duration, or intensity.

Instead, the current consensus among scientists is that watershed reserve management and fire suppression activities have led to dangerous fuel accumulations. This deadly combination promotes fire-prone areas that leads to recent wildfires.

For example, recent forest ecology studies on Southern California wildfires have concluded that temperatures have had little impact on these fires. The most significant factor, instead, is the amount of precipitation during the wet winter season that increases fuel accumulations, leading to more dangerous wildfires.

Simply, people who attempt to link global warming to increases in wildfires are misinformed. Global warming would increase drought conditions during the wet seasons, which would reduce the chance of wildfires in Southern California, not increase it.

Another common misperception is that all wildfires are bad for forests and should be suppressed.

North American forests have grown and prospered with fire for thousands of years, returning nutrients to the soil and promoting growth of older fire-resistant trees.

But decades of complete fire suppression activities, coupled with decreasing timber harvests and building of access roads, have created dense forests. These dense forests stands contain a multitude of small trees that compete with each other and with large, older trees for water, sunlight, and space.

This stress puts the forest stands in a weakened state and places them at a greater risk of catastrophic wildfires, diseases, and insect infestations.

Mr. Chairman,

Before we invoke the global warming religion once again as the culprit hiding behind every wildfire, we should first look at evidence right before our eyes on what is truly behind the recent trends.

The current consensus in forest ecology is that climate change has little to do with wildfires, and to link the two would not make good policy or sound science.

I look forward to hearing testimony from today's witnesses and yield the balance of my time.

The CHAIRMAN. And I will then turn as a result to our first witness, and that witness is Gail Kimbell.

She is Chief Gail Kimbell. She is the 16th chief and the first female chief of the U.S. Forest Service. Her long and distinguished career working in Federal forestry began in 1974. She has extensive experience working in our Nation's forests throughout the West, including Alaska, Oregon, Colorado and Washington. She assumed her current position as Chief of the U.S. Forest Service on February 5, 2007.

We welcome you, Chief. Whenever you are ready, please begin.

STATEMENT OF ABIGAIL KIMBELL, CHIEF, U.S. FOREST SERVICE; ACCOMPANIED BY SUSAN CONARD, NATIONAL PROGRAM LEADER FOR FIRE ECOLOGY RESEARCH, AND MARC ROUNSAVILLE, DEPUTY DIRECTOR FOR FIRE AND AVIATION, U.S. FOREST SERVICE.

Ms. KIMBELL. Thank you, Chairman.

Mr. Chairman and members of the Select Committee, thank you for inviting me today. I will focus my oral remarks on what the Forest Service is doing to address interactions between wildfire and climate change.

First, I would like to note that I am accompanied by Dr. Susan Conard. Susan is the National Program Leader for Fire Ecology Research, right behind me. And I am also accompanied by Marc Rounsaville, who is my Deputy Director for Fire and Aviation for the agency. And I also must disclose, because I understand there are some baseball fans, that everything I know about baseball, I learned in Fenway Park.

Mr. BLUMENAUER. Cheap shot.

The CHAIRMAN. No. But everything she learned about ecology, she learned in Yellowstone Park; okay? So we will just give deference to which park teaches which subject.

Mr. BLUMENAUER. Cheap shot. Cheap shot.

Ms. KIMBELL. Scientists tell us climate change may increase the incidence and severity of wildfire in some parts of the United States. Decisions made today by resource managers and policymakers will have implications throughout the next century. I am a forester with over 33 years of experience, but I am not a scientist.

Still, the Forest Service has some of the best scientists and research available on forests and climate change. For example, Forest Service scientists participated in the Intergovernmental Panel on Climate Change, the IPCC. They were recently awarded a Nobel Peace Prize, and they concluded that disturbances from pests, diseases and fire are projected to have increasing impacts on forests with longer fire seasons and large increases in areas burned. While we have much to learn about the interactions between climate change and wildfire, we are taking science-based adaptive management approaches today to reduce the impact of wildfires to mitigate the impacts of climate change on our Nation's forests and grasslands and to improve the forest potential for mitigating the effects of climate change.

I was in southern California last week, observing what is being done to suppress those fires and talking with fire crews and fire managers about their efforts. Along with the California Depart-

ment of Forestry and Fire Protection and other agency partners, the fire fighters are doing everything within their power and qualifications to contain those fires. Without question, we are seeing more wildfires covering more acres in recent years, a result of extended drought and the accumulation of fuels. Climate change is certainly a contributor to the factors affecting the current fire situation, but more needs to be known about the details. We need more information before we can conclusively answer the question of the relationship between wildfire and climate change.

A recent study by the department's Office of Inspector General found that the majority of the Forest Service's fire suppression costs were related to fighting fire in the wild land urban interface. According to our recently published, "National Forests on the Edge," just published last week, almost 22 million acres of rural private lands, about 8 percent of all private lands located within 10 miles of the national forest boundaries are projected to undergo increases in housing densities by 2030. This coupled with climate change factors of drought and warmer temperatures will increase the complexity and the costs of fire fighting. The Forest Service has conducted over two decades of focused climate research, three decades of air pollution research, and has long experience in scientific assessments that provide a firm scientific foundation for addressing the challenge of forest and rangeland management relative to climate change. Forest Service research and development continues to study the interactions between factors affecting fire behavior and the potential effects of changing climate on fire patterns and vegetation. There are important knowledge gaps we must address, such as wide variability and the estimates of fire emissions.

While we have information for a few systems, we do not have good information on all systems of how burn severity affects emissions or vegetation recovery. Current models of smoke dispersion need to be improved to more accurately predict the potential effects on human health. We are developing improved projections of the impacts of changing precipitation patterns on forest ecosystems to help us adapt to and mitigate those changes. In partnership with other land managers, we are working to identify the landscape level forest conditions most likely to sustain forest ecosystems in a changing climate.

The IPCC in its fourth assessment report states, in the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks while producing an annual sustained yield of timber, fiber or energy from the forest will generate the largest sustained mitigation benefit. Forestry can make a very significant contribution to a low-cost global mitigation portfolio.

It is important to note that not only can forests store carbon and help mitigate greenhouse gas emissions, they can also provide clean water, wildlife habitat and recreational opportunities among other significant environmental and economic amenities.

Other elements of a broad strategy include treating fuels to reduce the threat of wildfire to community and to other forest values, keeping forests in forest, keeping forests healthy and reforesting degraded lands. While recent wildfire activity reflects some of what we have experienced with climate change, management of fire and

vegetation and thoughtful restoration, including that of burned areas, can and should be part of the solution. Communities of vastly different interests across the country are witnessing changes in the forests they care about, and they are coming together to develop guidelines to support forest restoration.

The Forest Service has focused resources on improving forest health and the resilience of ecosystems to climate change. Many of the approaches we use to reduce fire risk and restore fire-affected systems also improve forest health and productivity and increase the resilience of America's forests to changing climate. Although forests are not the solution to controlling greenhouse gases, forests and sustainable forest management must be part of a broad set of strategies that contribute to the solution. Thank you for the opportunity to discuss these issues with the committee. And I would be happy to answer any questions you might have.

[The statement of Ms. Kimbell follows:]

STATEMENT OF
ABIGAIL KIMBELL
CHIEF
FOREST SERVICE
UNITED STATES DEPARTMENT of AGRICULTURE

BEFORE THE
UNITED STATES HOUSE OF REPRESENTATIVES
SELECT COMMITTEE ON
ENERGY INDEPENDENCE AND GLOBAL WARMING
NOVEMBER 1, 2007

CONCERNING

WILDFIRES AND CLIMATE CHANGE

Mr. Chairman and members of the Select Committee, thank you for inviting me today to discuss wildfires and climate change. I will focus my remarks on the interactions between wildfire and climate change, wildfire costs, research on wildfires and climate change, and the forest management practices we are employing to address these issues.

The Interactions of Wildfire and Climate Change

That the Earth's climate is changing means decisions being made today by policymakers and resource managers will have implications through the next century. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) shows that there have been clear patterns of temperature increase and long-term trends in precipitation change around the world since 1900. Results from over 20 different global models project strongly increasing temperatures for much of the globe, with the greatest increases generally projected for northern latitudes. The IPCC concluded that disturbances from pests, diseases, and fire are projected to have increasing impacts on forests, with longer fire seasons and large increases in area burned.

For North America the greatest increases in winter temperatures are projected in the boreal and arctic zones, with summer temperature increases the greatest across the lower 48 states in the United States. Precipitation is projected to decrease in the southwestern United States, and increase in some areas of the northeast. We can expect these temperature and precipitation patterns to lead to longer and more severe fire seasons in many areas of the United States and Canada, which underscores the need to continue to engage in active forest management as a mitigation measure.

While climate has always been variable, the suite of climate models evaluated by IPCC project an increased frequency and intensity of drought and high-intensity rainfall events, particularly in the boreal and temperate zones of the northern hemisphere. Historically, the extent and severity of drought, timing of spring snowmelt, and changes in ocean circulation patterns have all correlated with the extent and severity of forest and rangeland wildfires.

In some systems in North America (such as ponderosa pine and loblolly pine forests which historically had high frequency, low severity fires) reduced fire frequency beginning in the late 19th century has led to substantial fuel accumulation. These fuels increase fire hazard and burn severity, a condition that can be exacerbated by a warming climate and longer fire seasons (e.g., Westerling et al, 2006)[1]. Drought stresses trees and other vegetation, causing increased flammability of live and dead fuels and increased susceptibility to a number of insects (most notably bark beetles) and some pathogens.

Even with active restoration management at the landscape scale, large and severe forest and rangeland wildfires are more likely under dry conditions. However, fuels management can reduce fire intensity. Many areas of the United States have warmed over the past 40 years, with the greatest changes occurring in northern latitudes and in the western United States, where increases in temperature will result in earlier snowmelt and increased evaporation.

Wildfire Costs

Factors including changing temperatures, prolonged drought across many portions of the West and Southeast, and an expansion of the area and number of people living in the wildland-urban interface are expected to result in continued increases in acres burned, which will place additional pressure on fire suppression costs.

A recent study by the Department's Office of Inspector General found that the majority of the Forest Service's fire suppression costs were related to fighting fires in the wildland urban interface. According to our recently published report National Forests on the Edge, almost 22 million acres of rural private lands (about 8 percent of all private lands) located within 10 miles of the national forest boundaries are projected to undergo increases in housing density by 2030.

Climate Change Research

The Forest Service and the Department of the Interior provide long-term research, scientific information, and tools that can be used by managers and policymakers to address climate change impacts to forests and rangelands. Scientists from the Forest Service and the Department of the Interior also participate in the IPCC. The Forest Service has conducted over two decades of focused climate research, three decades of air pollution research, and has long experience in scientific assessments that provide a firm scientific foundation for addressing the challenges of forest and rangeland management relative to climate change.

The Forest Inventory and Analysis Program and more recent Forest Health Monitoring Program, for example, have tracked the status of and changes in vegetation on public and private lands for more than 75 years. The nationwide network of experimental forests

[1] Westerling. A.L., H. G. Hidalgo, D. R. Cayan, T. W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science. 313(5789): 940 – 943.

and ranges provides up to 100 years of data on climate and hydrology. Further scientific support comes from partnerships with universities, federal and state agencies, non-governmental organizations, and the forest industry. Scientists and managers are using this information and working together to develop strategies for managing our changing forests and rangelands.

Forest Service Research and Development continues to study the interactions between fire and climate, factors affecting fire behavior and the potential effects of changing climate on fire patterns and vegetation. New research is addressing interactions between insect mortality and fire behavior. We are working to develop improved projections of the impacts of potential climate changes and methods to help us adapt to and mitigate those changes, including developing improved models to project the effects of climate change on future fire patterns in North America.

USDA agencies, including the Forest Service, are active in the United States Climate Change Science Program (CCSP). USDA is the lead for CCSP Synthesis and Assessment Product 4.3 on the effects of climate change on agriculture, land resources, water resources, and biodiversity, which is expected to be completed this December. A primary goal of the report is to enhance our understanding and ability to estimate impacts of future climate change on these systems and resources in the United States. This report is being prepared by the Department's Global Change Program Office with significant contributions from the Forest Service.

There are important knowledge gaps that need to be addressed. For example, current estimates of fire emissions vary widely. While we have information for a few systems, we do not have good information broadly on burn severity or on how burn severity will affect emissions or vegetation recovery. Current models of smoke dispersion need to be improved to more accurately predict the potential effects on human health. We also do not know how much we can increase carbon storage without causing unacceptable increases in fire hazard in fire-dominated ecosystems. Gaps in information about the timing, scale, and location of climate change impacts also exist. Climate models lack the ability to provide projections at the detailed scale that is most useful to land managers and local and regional planners.

Our scientists are looking for better ways of forecasting how ecosystems will change in response to a changing climate and how the changes will affect animals and plants that depend on these ecosystems. In partnership with other land managers, we will work to identify the landscape-level forest conditions most likely to sustain forest ecosystems in a changing climate.

Forest Management Practices

Each year, we manage the vegetation on millions of acres of National Forest System land to make forests more resistant to wildland fires, insects, and disease and more resilient to major disturbances such as a large wildfire. These same treatments can make our forests better able to withstand the stresses associated with climate change.

Our options include protecting the existing carbon sink through forest conservation and increasing carbon sequestration through reforesting degraded land, improving forest health, and supporting sustainable forest management. Many years of applying scientifically credible silvicultural techniques has proven the ability to increase forest growth and thus the storage of carbon. The use of forest biofuels for energy and the substitution of wood for manufactured products are other opportunities for managing carbon.

In many parts of the United States, forest health has decreased due to stress factors such as drought and increased stand densities. Active management of forests, as encouraged under the Healthy Forests Initiative and Healthy Forests Restoration Act, can help reduce the impact of wildfires on climate change and mitigate the impacts of climate change on our nation's forest and grasslands. The size and intensity of wildfires can be limited by reducing stand density and treating fuel buildup.

From 2001 through 2007, Federal land management agencies have treated approximately 25 million acres for fuels reduction on federal lands, including 18 million acres treated through hazardous fuels reduction programs and over 7 million acres of landscape restoration accomplished through other land management activities. Many of these projects have significantly reduced the impact of subsequent wildfires. Through the use of wildfire threat mapping and decision support tools, funding to address fire suppression and fuels reduction is being directed to areas where it can be most effective at reducing wildfire threats to communities and natural resources.

There is good scientific basis for vegetation treatments in appropriate fire regimes to reduce wildfire severity; treatments will reduce stress and crowding of vegetation and increase resistance to severe drought and to bark insects. Because climate in many areas will change more rapidly than long-lived plant species can migrate, planting a mix of species that may be better adapted to current and future climates may be appropriate following moderate to severe fires.

We are also finding ways to use the smaller diameter woody biomass in wood products that can store carbon. Forest biomass from fuel reduction projects can be used for bioenergy and wood products – this will decrease the net effective emissions from wildfires, offset fossil fuel emissions, and help to increase carbon storage. Scientists are evaluating options for incorporation of organic matter from forest fuels into the soil, where it may decompose slowly, and not add to fire hazard as much as if left on the surface. While wildfire is a part of the problem of climate change and carbon storage, collaborative management of fire and fuels and thoughtful restoration of burned areas can be a part of the solution.

Conclusion

In the future, we expect that changing climate will lead to shifts in vegetation and species distribution and disturbance patterns, none of which respect administrative boundaries. While we still have much to learn about the interactions among climate change, carbon emissions, and wildfire, there are science-based adaptive management approaches we are

taking today that can help reduce the impact of wildfires on climate change and mitigate the impacts of climate change on our nation's forest and grasslands. We are working with our partners to adapt our fire management practices and forest and rangeland management programs to anticipate the effects of climate changes and mitigate the potential impacts.

We are focusing on improving forest health and resilience of ecosystems to climate change by managing forests to reduce fuels and achieve healthy conditions. Federal, state and local managers are working together to increase community preparedness and to reduce fuel hazard and the likelihood of uncharacteristically severe fires and insect infestations. Many of the approaches we are using to reduce fire risk and restore fire-affected systems may also increase the resilience of America's forests to changing climate. Through active management, we are trying to increase the health, resiliency and productivity of fire-affected ecosystems across the United States.

Thank you for the opportunity to discuss these issues with the Committee. I would be happy to answer any questions that you have.

The CHAIRMAN. Thank you so much, Chief, for being here at this time. Let me turn first and recognize myself and ask you, do you consider wildfire a threat to public welfare?

Ms. KIMBELL. Wildfire, you know, certainly in the last several years, we have seen an increase in the size of wildfires and the number of large wildfires. We have seen the number of fires over 100,000 acres increase pretty dramatically since 1990. You can see in this graph here the increase since 1990. The blue diamonds indicate the number of fires over 100,000 acres. Those are the very expensive fires. Those are the very troubling fires, and many of those fires are the ones we are talking about, like in southern California, with the nearly 2,000 homes burned just in the last week and a half.

The CHAIRMAN. May I ask, do you think that CO_2 emissions are without question contributing to global warming?

Ms. KIMBELL. I am not a scientist. But I can say that we have measured certainly CO_2 emissions from fire. We have measured carbon monoxide and methane along with other volatile gases. And they should be of a concern to all of us.

The CHAIRMAN. Well, it is 6 months since the Supreme Court rendered its decision in Massachusetts v. EPA, asking the EPA to make a ruling on whether or not CO_2 is a danger. And it has yet to do so and, as a result, has yet to have to then make decisions as to what it is going to do about it. So that really does create some problems for us.

I solicited some questions online yesterday, and I wanted to share one with you from someone who lives in Missouri. He was concerned that as global warming widens the area subject to wildfire conditions, it could reach into areas of his State and other States that are not used to having wildfires and are ill-prepared to fight them. If climate change expands the number of areas at risk of wildfires, it could take many communities by surprise. What areas of the country should begin to contemplate wildfires for the first time? And what can be done to educate other communities unaccustomed to wildfires?

Ms. KIMBELL. Well, the Congresswoman from Michigan mentioned the Lake States, and certainly, we had some pretty active fire in northern Minnesota this summer. The northern latitudes in the more real forests are experiencing some of the greatest change with climate change, and certainly, we need to be paying attention and focus there. The drought across the southeast United States right now in Georgia, Tennessee, Kentucky, South Carolina, we are experiencing drought and fire danger in a way that those communities are not accustomed to in October of a year. The fire that burned out of the Okefenokee Swamp this spring and burned so many acres in Florida, creating not only a huge health risk but certainly destroying a lot of people's livelihoods, burned a lot of private timber. And fortunately when it hit some treated lands, some areas where the hazardous fuels had been reduced, we were able to suppress that fire.

But there are communities not only in the northern latitudes and in the more real forests where climate change is the most pronounced or we expect the effects to be most pronounced, but certainly there are communities experiencing prolonged fire seasons

that may have been prepared for a 2- or 3-month fire season and are now looking at having to prepare for a much longer fire season.

The CHAIRMAN. And one final question.

Recently Centers for Disease Control Director Julie Gerberding testified before the Senate on the impacts of climate change on global public health. In her draft testimony, she stated that, because of climate change, quote, forest fires are expected to increase in frequency, severity, distribution and duration. The Bush Administration removed that statement from her final testimony. Do you agree with that statement?

Ms. KIMBELL. I think we can demonstrate higher severity, larger fires and certainly over the last 7, 8 years, more frequent fires and a longer fire season.

The CHAIRMAN. Well, I thank you for that testimony.

I now turn to recognize the gentleman from Wisconsin, Mr. Sensenbrenner.

Mr. SENSENBRENNER. Mr. Chairman, I ask unanimous consent that my time be given to the gentleman from Oregon, Mr. Walden.

The CHAIRMAN. Without objection, it will be so ordered. And Mr. Walden is recognized for that purpose.

Mr. WALDEN. Thank you, Mr. Chairman.

And thank you, Mr. Sensenbrenner.

Chief, I welcome your testimony today. I thought it was excellent, and I also appreciate the service you give to the Forest Service and many States, especially my home State of Oregon, and your days as ranger up in Le Grande. We appreciate your leadership there. I would like to follow up on several points. There is an Associated Press story out today that says that southern California wildfires emitted the same amount of carbon dioxide in the atmosphere as that State's power plants and vehicles do for a year, some 8.7 million tons, which is more than the entire power emissions from the State of Washington, 6.5 million tons.

Clearly these wildfires do emit pollutants into the atmosphere. And it seems to me that your agency needs additional resources and help to deal with mitigating these levels of fires we are seeing in recent years.

Now can you speak to the difference, for example, in a State like mine or a region like mine in sort of the arid eastern sides of the States of Washington and Oregon and the forest regimes there versus the western side where we don't necessarily see the same types of fire, and the importance of changing the structure of those forests to make them more compatible with their natural environment, that hasn't existed for 100 years since we started suppressing fire. What do you need? What tools do you need? Does HFRA work? Are you using it? Healthy Forest Restoration Act. And is that adequate?

Ms. KIMBELL. Tools. We are absolutely using the Healthy Forest Restoration Act. Since the inception of the National Fire Plan, all the Federal agencies together have treated 25 million acres of hazardous fuels. That is in the original reports that set up the National Fire Plan. There was an estimated 190 million acres that had excessive fuels. And to date, we have been able to treat 25 million acres, working with community and community wildfire protection plans.

Mr. WALDEN. Now we have seen fires, like the fires in Tahoe, where your agency had wanted to go in and do treatment to remove hazardous fuels from wild land urban interface. What precluded that treatment from occurring?

Ms. KIMBELL. Well, in fact, I was able to visit the Angora fire this summer there at South Lake Tahoe and able to visit with forest staff, able to visit with community members who had been so involved. I was able to visit with the chairman of the Tahoe Regional Planning Authority. I also asked our scientists to put together an assessment of fuel treatments in the South Lake Tahoe area. We actually conducted transects through the burned area, the areas that had been treated prior to the fire.

Mr. WALDEN. I am going to have to move you along a little quicker. I am going to run out of time here. What delayed the treatment?

Ms. KIMBELL. There is a lot of very complex agreements in the Lake Tahoe area. There are a lot of complex agreements all over. It is not just Lake Tahoe, but certainly there is a certain amount of social license that will allow a lot of different activity to take place in a forest, and sometimes there are things in the process that can really hold up, prevent, delay treatment of hazardous fuels. And I think we have examples of that certainly all over the West.

Mr. WALDEN. All right. Okay. Let me give you an example in my district. A fire that burned this summer outside of Sisters, Oregon, came roaring over both private land and Federal, started by lightning, came down into an area that they had been trying to thin since I think 2000 or 2001. And that thinning project had been under appeal by different groups or a group. Finally, they had gotten through the court system, and the Forest Service prevailed, and the thinning had occurred. When the fire hit that area that had been thinned, it went to the ground. They were able to put it out.

Ms. KIMBELL. Absolutely.

Mr. WALDEN. But it took them years and years and years to fight through to be able to get that thinning done.

And it strikes me that much of your agency's time is still spent in litigation and fighting appeals and in the courtrooms rather than on the ground doing the treatment that your foresters are educated to provide. And we are never going to get ahead of this 190 million acres of area that needs some work if you are always backlogged. And that same forest actually has HFRA-approved projects out 5 years and yet lacks the funding to go implement some of those. So it is a funding issue, and part of that gets back to how much are you spending this year fighting fire, $1.2, $1.4 billion?

Ms. KIMBELL. $1.34.

Mr. WALDEN. And how much now have you had to dip into these other accounts on an emergency basis to pay for fire fighting?

Ms. KIMBELL. We had to dip into other accounts, $100 million.

Mr. WALDEN. And would any of those accounts effect work out on the ground this season?

Ms. KIMBELL. Not those accounts specifically but the continuing effect when you work those numbers into a 10-year average, and

then you look at your out year budget. In preparing the fiscal year 2009 budget, I had to find $300 million to move out of other projects to move into fire suppression to meet that 10-year average. That $300 million comes from everywhere.

Mr. WALDEN. And does that include coming from how we maintain campgrounds and parks and other recreational activities out on the Federal land that now we are having to scramble or you are closing because you don't have those resources?

Ms. KIMBELL. And in fact, it also comes from vegetation treatment.

Mr. WALDEN. All right. Then some vegetation treatment funding remains an issue that we need to deal with. Post-fire recovery, I think Congresswoman Herseth Sandlin and I authored the Forest Emergency Recovery Research Act. It was probably among other things providing the biggest funding source to enhance the science of post-fire post-disaster recovery. It passed the House, went up where all good bills go to die in the Senate. I believe we need more research to be done so we get it right and we don't make mistakes.

But, in the meantime, you have a lot of long-term management practices that you all know what works and what doesn't work. And am I correct that you still have more than a million acres of Federal forest land post-fire that have not been replanted?

Ms. KIMBELL. That is correct.

Mr. WALDEN. This isn't post-timber harvest share commercial sale program because that is required to be replanted in—as I recall from the GAO report a year ago, is replanted. So we are just talking post-fire. It is lands like this that go untreated. Now my understanding on this Egley fire is that there are those in the environmental community who are telling the Forest Service, they won't appeal if you don't harvest more than 19 trees on 140,000 acres. Now we are still running that out. But that is what I have been told, 19; 140,000 acres. We have had half a million acres in my State burn this year. This is getting out of control. We have to change Federal policy. Or this place isn't going to get replanted. "That will come back naturally." You will hear that. "Oh, yeah, don't do anything. You are better not to disturb this; just leave it the way it is."

I will tell my colleagues, nobody else leaves it the way it is; not private forest managers, not county forest managers, not State forest managers, not tribal forest managers. Only we do this in a tribute to burned and destroyed watersheds and habitat. And I just get sick of it because nobody else does this. I held hearings when I chaired the Forestry Subcommittee. Tribal nations are in—even in my State—hauling out burned dead trees while they were smoldering. Not the best transportation practice, but they admitted to it. The State of Oregon under—one of the most aggressive forest management practice laws in the country, if not one of the first, one of the most aggressive, goes in immediately after fires on their lands and does the rehab work.

And how long does it take you to come up with a plan to come in after a fire?

Ms. KIMBELL. Well if it is not done within the first 3 years, then the value is such that——

Mr. WALDEN. But it takes you a year to come through the planning process; correct?

Ms. KIMBELL. At least.

Mr. WALDEN. And then you have the appeals process and that can take a year; correct?

Ms. KIMBELL. The appeals process should only be 90 to 120 days.

Mr. WALDEN. But with the seasons for harvest and activity in the forest, it can delay you into the next year; correct? You can't work in the winter in some areas.

Ms. KIMBELL. Yes. That is correct. And then, too, if something is litigated, and it goes to court, then it can be 5, 6, 7 years.

Mr. WALDEN. Right. So you lose the value so you don't get the funding into your agency to do the restoration work. And if you replant sooner, you are going to produce a forest sooner, and you are going to sequester carbon sooner. Doesn't your science show that as well?

Ms. KIMBELL. The science absolutely shows that, that healthy vigorous growing trees sequester carbon. Those don't.

Mr. WALDEN. Exactly. And so, Mr. Chairman, I hope we can find some common ground here to become better managers and give the Forest Service better tools to make the right decision not to wipe out every—I have never supported that. You don't go ahead and clear cut all this stuff. But there are areas where you can recover. There are areas where you drop them to stop the erosion. They do a really good job with their bear teams coming in after a fire; they will drop some of these trees horizontally to the hillside so that it will stop the erosion because otherwise this all runs into the watershed. I know I have used up my time. But I appreciate your testimony and the work you are doing. And we will continue to do our part here.

Ms. KIMBELL. Thank you, Mr. Walden.

May I add one thing? I did mention social license. And I think the work that is going on in so many communities is very encouraging to me where many diverse interests are coming together and talking about what needs to happen, what do they want to have happen in the forests that means so much to them? We have got some great examples of that around the country. But maybe since hurricanes were mentioned this morning, the work that happened in Mississippi following Katrina, working with wild law, working around a common vision of what long leaf pine restoration should look like, we were able to accomplish just a huge amount of restoration work using salvage logging and other methods. But restoration work in those long leaf pine ecosystems in Mississippi took a lot of work on the part of a lot of people but had very positive results.

Mr. WALDEN. And you were able to use the Healthy Forest Restoration Act; weren't you?

Ms. KIMBELL. Yes, we absolutely were.

The CHAIRMAN. The gentleman's time has expired. The Chair recognizes the gentleman from Oregon, Mr. Blumenauer.

Mr. BLUMENAUER. Thank you. And I deeply appreciate, Chief, your looking at the big picture because people are focused on southern California. But it is up in the Great Lakes region. Well, there are certain irony because the Governor of Georgia is now trying to

short cheat Alabama and Florida by keeping their—what they think is their water and threatening not just endangered species but coal communities and the fishing industry because they haven't got their act together. And with the climate change, with development in the flame zone, we are going to see this all across the country.

And I do appreciate the comments from my friend and colleague from Oregon because there are lots of things that communities can come together on and deal with some absolutely noncontroversial treatment on the urban fringe. And we might actually be able to extract some wooden biomass that will help with some of our other fuel issues.

But I guess we can't do this if you are going to be spending more and more and more of your money that you are charged with managing on a problem that is getting ever larger. Because it is not just smart forest practices that impact fighting fires. The figures I have given, for example, you had a 600-acre fire in the Jebediah Smith wilderness that costs maybe $20,000 to fight when you are dealing with 600 acres. In contrast, there was a 250 acre fire near the town of Wilson, Wyoming, that cost more than 10 times as much because of the proximity. And there are orders of magnitude—I mean, I am assuming that we can be looking at orders of magnitude that are 100 or 1,000 times greater because of the infrastructure and the people involved. Is that correct? Do I have that right?

Ms. KIMBELL. Certainly, it is much more expensive where you are up against community development, yes.

Mr. BLUMENAUER. And you are already cannibalizing the budget to deal—you are making difficult priority decisions.

Ms. KIMBELL. We are making very difficult priority decisions in order to be able to have funds to be able to suppress fires when they are up against those communities.

Mr. BLUMENAUER. But they are undercutting the long-term issues of health and recreation, research. I mean, you are having to thin all of your activities with this exploding problem.

Ms. KIMBELL. We have made some very difficult adjustments, yes.

Mr. BLUMENAUER. I was struck in your testimony where you talked about the 22 million acres of rural private land within 10 miles of the core national forests that are projected to undergo very significant increases in housing density over the course of the next two decades. Is the Fire Service—I mean—excuse me—is the Forest Service—how could I make that Freudian slip?

Is the Forest Service developing some policies, programs, recommendations to us to deal with this impending massive complication for your already difficult task?

Ms. KIMBELL. Let me offer two different things. We are getting ready to—we have just published this National Forests on the Edge. We will be publishing our open space strategy next month. It contains several different things. One of those is that we have been working very diligently with a number of different bodies, looking at things like environmental services, looking at carbon, carbon markets. We have the science that we can bring to that discussion, and we have been doing that. We have been working very

hard to bring science around carbon accounting, science around water, science around all the different things that people take for granted coming from forest lands, whether they are public or private. With our open space strategy, we are addressing in a very real way what is happening with forest land across the United States. There are 800 million acres of forest land in the United States.

Mr. BLUMENAUER. Let me be clear because my time is running out.

Are you formulating specific policy recommendations to help solve the problem—not quantifying it; I appreciate the research—but policy recommendations that would make this problem diminish?

Ms. KIMBELL. Make it diminish. I think forests are so important. You will find in that open space strategy quite a number of suggestions for policy considerations in there. Certainly there are things that we will take on as an agency, but there are some things much bigger than we are as an agency that hopefully the U.S. Congress will address.

Mr. BLUMENAUER. Thank you very much.

Mr. Chairman, I apologize. We have a Ways and Means markup that is going on now. But my slipping away is not any reflection on how I think this is a critical hearing, and I hope that there is a way to focus broader attention on the wide range of issues here. And I really appreciate you putting it on.

The CHAIRMAN. Well, we thank you for being here because you have a long career in focusing on these issues. And it helps us to hear your questions and comments to the witnesses. Thank you. The gentleman's time has expired.

The Chair recognizes the gentlelady from Michigan, Mrs. Miller.

Mrs. MILLER. Thank you very much, Mr. Chairman. And Chief Kimbell, we certainly appreciate your expertise on this issue. I am not an expert on the issue, but hopefully this question is appropriate here. But I am just trying to understand. In your testimony, you mentioned about housing density and increasing housing density, people moving into areas that are heavily forested. And I, along with the rest of the Nation, watched with sort of morbid fascination on the TVs, watching this whole thing happen in southern California, and there was a lot of talk about vegetation and undergrowth that normally would either burn off or naturally be destroyed or die off in some format, but because there are more people living there now, that is not happening. So it essentially acts as an accelerant for some of these fires because, I mean, we have had the Santa Ana winds forever. It just didn't happen at this time.

I am just wondering what your thoughts are about having such a significant amount of people moving into heavily forested areas. And I ask that question in this context coming from the Great Lakes. We just had a big debate here about flood insurance. And many people were saying, why is the Federal Government continuing to pay for housing that is destroyed in floods that are going to happen? I mean, it is no secret; it is going to flood again at some point, and people rebuild. And I actually came from local government. I am a huge believer in local control and planning zoning or-

dinances, having the impetus and coming from local planners, et cetera. But do you think there is anything that may be appropriate for the Federal Government to do to dissuade people from continuing to move into heavily forested areas that we may know are going to have a forest fire in the future?

Ms. KIMBELL. Well, the Forest Service in working with the States and with local agencies has worked very diligently on Firewise. It is a program by which we advise local land owners, local communities on different things where they might structure ordinances, where they might talk about building materials and vegetation around homes. And many communities have adopted those. Many people have implemented those around their own homes, whether or not their neighbors have. But certainly all that work in Firewise has been very, very important.

At the same time, we are talking about a population that is now 300 million people and, by the middle of this century, maybe 400 million people or more. All those people are going somewhere. And the national forest lands provide a real draw to people seeking amenity values, and so we find in this report, National Forests on the Edge, but we have a companion report that is about all of America's forests, people are seeking out amenity values and locating—because telecommuting is such a possibility now and wireless is available in so many places, people are choosing to live in those forested environments. But they need to do that with the understanding of what they are moving into and with the understanding that they need to be very aware and treating the landscapes around them.

Mrs. MILLER. Thank you very much. Yes.

And I yield the balance of my time to the gentleman from Oregon.

Mr. WALDEN. Thank you. I just want to follow up because the question came up about wilderness. And I know we have had some fires that originated in the wilderness. What can you do to manage bug infestation, overstocking, disease and dead trees in a wilderness area?

Ms. KIMBELL. We do not manage natural processes in the wilderness areas. By statute, those are managed by mother nature.

Mr. WALDEN. And so when a fire breaks out in a wilderness area, are you able—I know technically you are allowed to involve aggressive fire fight tactics. But generally that is reserved if there is life or casualty. I mean, isn't that right? Don't you employ different fire fighting tactics in wilderness area versus outside a wilderness area?

Ms. KIMBELL. We do. But again, that is based on the values at risk. We go through quite an analysis at the start of a fire to look at values at risk and then assign tactics and strategies. So if you are in a very expansive wilderness area—there is a gentleman here from Montana who was probably breathing smoke most of this summer. And they will remember the fires this summer in a number of different wilderness areas that did not have aggressive fire fighting techniques until there were significant values at risk.

Mr. WALDEN. Generally, you let those burn if they are in a wilderness area?

Ms. KIMBELL. Generally, we manage the edges to avoid having them become something much bigger than—to be burning other resources, to be getting into other resources.

Mr. WALDEN. Because it seems like we are seeing more and more of these lightning fires originate, in some cases in the wilderness areas where there have been some problems with bug and drought infestation and no management and those come roaring out of there and then into other areas private and public. Are you seeing that?

Ms. KIMBELL. Yes. There have been some examples of that. And certainly in southern California, because of the immediate values at risk on the very edge of the wilderness boundary, there are some times where we have employed more aggressive fire fighting techniques than perhaps were experienced this summer in the Bob Marshall wilderness area there in Montana. But yes, we have seen some examples—because those forests within wilderness areas are undergoing all the same stresses with climate change that forests outside wilderness areas are. They are just as susceptible to a lightning strike.

Mr. WALDEN. But with none of the management activities.

Ms. KIMBELL. Correct. Without the management activities, including without the access.

Mr. WALDEN. And I am sure there are fires that start outside the wilderness areas and burn in.

Ms. KIMBELL. Yes. Those are two examples.

Mr. WALDEN. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. The gentleman's time has expired. The Chairman recognizes the gentlelady from South Dakota, Ms. Herseth Sandlin.

Ms. HERSETH SANDLIN. Thank you, Mr. Chairman.

Chief Kimbell, thank you very much for your work and your service. I also want to commend to you the terrific work of the Forest Service officials in the Black Hills National Forest and the great work they are doing with their local partners, including the local timber industry, to pursue a number of thinning projects in the wild land urban interface. Just a few weeks ago, in addition to having Mr. Walden in South Dakota, a couple of years ago, Mr. Norm Dicks, Chairman Dicks was in South Dakota just a couple of weeks ago and was also very impressed with the efforts there, and looking forward to working with him and with you as relates to the budgets necessary to not only fight fires but also to continue with these important projects, particularly when they do involve commercial timber sales that actually allow receipts that can continue with additional projects and the patchwork that we have in the Black Hills National Forest.

I certainly empathize with the folks in southern California. As you know, we had a devastating fire in the southern hills near Hot Springs that resulted in a number of homes and other structures lost as well as a gentleman who lost his life, firefighters who were injured. And so I come at this being convinced by the science that climate change has led to the increased frequency, the increased severity, of these fires which, while we haven't hammered out the precise and best solution yet on how we manage carbon by putting

a price on carbon, but I am also convinced that as climate change is exacerbated, drought, insect infestation, the fuel load, the timing of the snow melt, that we also have to manage carbon not only to reduce the threat of the forest fires, but to enhance the potential of our natural forests as carbon sequestration carbon sinks.

And so I wanted to probe with you an area that I think is very important and has vast potential, and that is biomass.

Now, every forest is unique, and the Ponderosa pine regenerates itself at a significant pace. And I have been told by some that I have been working with, as they are trying to partner to figure out in the Black Hills, do we have significant biomass to support either cellulosic fuel production or for renewable electricity generation, that the average amount of woody biomass just from the slash piles that exist would be sufficient to maintain some amount of electricity generation if a project was pursued there.

Can you talk about what activities the Forest Service is undertaking to assess potential wood waste as a source for biomass either for fuel production, cellulosic fuel production or electricity generation? And do you have any barriers currently that may inhibit moving forward if your assessments and research suggest that that would be a good source to help reduce the fuel load?

Ms. KIMBELL. Thank you, and—I can get into that, and if I can't get into enough detail, I am going to have to ask Dr. Conard to join me.

Actually, we are doing quite a bit at the Forest Products Laboratory in Madison, Wisconsin, in looking at the opportunities for using woody biomass for ethanol. And the technology is very, very close. There are people in Georgia—not Forest Service people, private interests in Georgia—working on the very same or similar kinds of technologies ready to go into production just as soon as that technology is more certain.

A barrier right—the—let me back up a little further.

It would require not only those slash piles from the Black Hills National Forest, but would require a woody biomass from all forest land. If we were able to access that woody biomass that is not currently being used for other products and is excessive to the needs for soil processes and wildlife habitats and those kinds of things, we estimate that we can offset up to 15 percent of the fossil fuels currently being burned with the use of woody biomass for ethanol.

Now, there is a measure in there, though, of the price of oil. And so it is all—all of this works together. I am not an economist, but all of this works together, and it is dependent—the efficacy of the technology is also dependent on the price of oil and its competitiveness.

Ms. HERSETH SANDLIN. Thank you for that response.

And then if you could address maybe two other issues, not just in terms of the potential for biomass, but then the thinning projects that are undertaken and reducing the density of the stands.

Do you feel that you have sufficient research, or you are pursuing that, that would suggest that by thinning and reducing the density of the stands, that that enhances the carbon sequestration potential of the forest?

Ms. KIMBELL. Yes. In fact, we have got some excellent science that demonstrates that exactly.

Most recently, an article was published in the Journal of Forestry by Dr. Susan Stout, who is one of our project leaders in Pennsylvania. And she had looked at different management regimes in the Allegheny hardwoods and was able to demonstrate that she could maximize carbon sequestration with a managed stand; and she had different sort of cultural regimes that she had looked at.

But Susan's study isn't the only one. There are many other studies that will demonstrate something similar. We do not have science for every single forest ecosystem that we do manage, and we are continuing to work on that part of science.

Ms. HERSETH SANDLIN. And one final question.

I know you had stated on page 3 of your written testimony that there are important knowledge gaps that we need to address, including the estimates of fire emissions that do vary widely.

Do you have any in terms of the AP article, that I believe Mr. Walden cited, in terms of the amount of emissions of the southern California fires as compared to the amount of emissions by power plants? Do you have any comments on the statistics cited in that Associated Press article?

Ms. KIMBELL. May I ask Dr. Conard?

The CHAIRMAN. Could you please identify yourself for the record?

Ms. CONARD. I am Dr. Susan Conard from the U.S. Forest Service.

So the question—could you repeat it again? Thanks.

Ms. HERSETH SANDLIN. Yes. Very quickly. The Chairman is being indulgent in letting me ask this question when my time was about to run out.

But based on the knowledge gaps that I think—you know, there is some consensus, the estimates are varying widely on the amount of emissions from the wildfires. So do you have any comments specifically?

I don't know if you have seen the Associated Press article yet that compared the amount of emissions from the southern California wildfires to the amount of emissions from the power plant it cited, I believe, in the State. Can you elaborate a bit on where you are headed with the research as it results to identifying the amount of emissions from the wildfires?

Ms. CONARD. Sure. And I actually haven't seen that particular article. We do have some independent estimates, that we consider quite preliminary, that the emissions from the southern California wildfires so far would be equivalent to about 3 to 5 percent of the fossil fuel and CO_2 emissions in the United States in a typical year. So that is probably a similar number.

In terms of estimating emissions nationally from wildfires, there are a number of different lines of work. Probably some of the most promising involves combining remote sensing information with information on models and measurements of full consumption in individual fires; and as that work proceeds, the numbers get more and more similar from different studies.

But I think right now, if you looked in the literature, you would see a variation of two or three times in the estimates.

The CHAIRMAN. The gentlelady's time has expired.

The Chair recognizes the gentleman from New York, Mr. Hall.

Mr. HALL. I just quickly want to ask a couple of questions before our votes get called.

Chief Kimbell, thank you very much for your testimony. I heard or read that around Lake Tahoe, that area of forest that the Angora fire burned, received last winter 29 percent of its average snowpack. Is that right?

Ms. KIMBELL. I can't confirm that number, but I know it was a reduced snowpack.

Mr. HALL. Okay. It has been mentioned in your testimony and others' comments that either reduced snowpack or earlier snowmelt obviously causes a drier forest and a longer fire season.

If you could, comment on thinning. There are different—people have different ideas of how to thin, and I believe somebody here or members on both sides of the aisle are thinning the underbrush and the dead trees and removing fuel.

There are also those who would like to thin by taking out commercially viable trees, and I wonder if you would comment on the—how efficient it is to remove healthy, large, commercially viable trees in terms of preventing or slowing fires.

Ms. KIMBELL. Everything depends on the site you are working on, and if your goal is to have healthy, vigorous trees on the—when you are finished with whatever projects you are undertaking, then you are going to be looking at a number of things, and one of those is available moisture.

It is the surrounding country, what you have on that site, what you anticipate might be a successful tree species or a successful individual tree into the future using the predictions of temperature, moisture, all of those things. So it is going to vary from site to site.

There are some sites that would be able to support all of what some people might want to define as "larger." There are other sites that might be able to support a smaller number of trees.

If a stand starts out at 6,000 stems to the acre, and it can reasonably support 40 large trees, there is a process of elimination when you get to those 40 large trees. Mother Nature has had a very interesting way of doing that on her own, and yet now we have people living in and amongst those forests.

So if the goal is to have a healthy, vigorous forest, it is going to be very important that the silva-culturalist, the person who is writing that prescription, is aware of what is happening there in temperature, water, soil processes, and all of those things.

Mr. HALL. So as Mother Nature makes the choice, we may want to help by removing the ones that don't make it from sprouts to full-size trees?

Ms. KIMBELL. One of Mother Nature's tools is fire.

Mr. HALL. I wanted to ask just quickly, are there any natural enemies of the bark beetles and other insects who have been decimating the forests, who perhaps are no longer there, and whether they could be reintroduced?

Ms. KIMBELL. One of the things that we have been seeing with climate change is a real difference in bird activity: when birds are nesting, where they are nesting, what elevation they are nesting. And for some of these insects that are forest pests—that is how they are classified—birds are an important part of that control mechanism.

We are also seeing that with the temperatures, many insects are having two breeding seasons in a year instead of one.

One of the natural controls has been temperature, and, you know, certainly that is something we have seen—actually we see it in Georgia and we see it in Montana—multiple broods of insects that aren't part of our historical information. But also we are seeing the movement of birds and just trying to figure out how those birds are now interacting with the insects that are moving around.

There are viruses, there are fungi, there are other insects that are—that prey on maybe the damaging insect.

I had a fascinating conversation with one of our researchers who had just been to China looking for tiny, tiny, teeny insects that feed on—the emerald ash borer; and the emerald ash borer, if you are in the Lake States, is just a huge threat to the urban forests all over the eastern United States.

So there are a lot of natural enemies. We are working with those and also examining what is happening with climate change that changes the efficacy of all of those.

Mr. HALL. And you would say that increased temperature would make all of these—the insects, the viruses, the fungi—have more opportunity to attack the forests?

Ms. KIMBELL. It makes things different, and that is the part that we are continuing to work with the science on.

For some insects like pine beetles, it has made them greater in number and covering larger areas.

Mr. HALL. Thank you, Mr. Chairman.

The CHAIRMAN. The gentleman's time has expired.

We will have time for Mr. Inslee and Mr. Cleaver for 5 minutes.

The Chairman recognizes the gentleman from Washington state, Mr. Inslee.

Mr. INSLEE. Thank you, Chief. I appreciated your testimony, but I have a lot of sadness about it for a couple of reasons.

One, I have seen firsthand the devastation that climate change is causing our forests. I was up in the national forest last summer at Robin and Tuck Lakes, places I have been for decades, and I have seen it ravaged by these beetles, literally one falling off my hat as I was talking to the forest ranger. And I said, What killed all of these trees? He said, Look at the brim of your hat. And there was a little worm falling off the brim of my hat.

I was in the Sawtooth last winter. I talked to a guy who was having to build these firebreaks because of the enormous beetle kill associated probably with climate change in Idaho. So I have seen this firsthand.

It is very painful to watch the unfolding death of our forests, and what I have a real sadness about is, despite your best efforts and the best efforts of the great people who work for you in these forests, the policies of George Bush are dooming these forests.

It doesn't matter what you do, as long as George Bush stands in the schoolhouse door and prevents us in Congress from doing things to stop global warming, these forests are going to die. It doesn't matter what you do; the forces are too great. As long as George Bush allows unchecked CO_2 emissions into the area, these forests are going to die.

And so I have a great sadness about the position you are in, trying to save that which is unsavable when the President of the United States won't help us deal with this mortal threat to these forests.

When I say "mortal," I mean mortal. Dead trees. When you go up to northern Washington, you see miles of dead trees up there right now. Same thing in Idaho. I don't know if George Bush has ever looked at that.

And I want to enlist you to really do something about this that can succeed in saving these forests. So I want to ask you to do what you can to really impress upon the President of the United States how destructive his policy is to these forests.

I want to ask you, have you told George Bush personally that his policies are killing the forests over which you have a stewardship responsibility?

Ms. KIMBELL. No.

Mr. INSLEE. That is a start.

Ms. KIMBELL. But I have been very outspoken about the need to have healthy, vigorous, growing forests; and there are a lot of different tools that we have talked about today to have healthy, vigorous, growing forests. It is so important to be cleaning carbon emissions from the air. It is so important to be sequestering carbon to have healthy vigorous forests, not just on national forests, but on all 800 million acres of forest.

Mr. INSLEE. I agree with you. But what I am trying to say is that no matter what you do—and I think your intentions are normal here. No matter what you do, as long as this climate is changing to entirely different regimes in these areas, they are going to be dead.

And I want to know whether—would you be willing to try to get in to see the President of the United States and personally tell him and show him, with pictures, the devastations that are happening in these forests so that maybe he would start to work with us to solve this problem?

Would you do that for us?

Ms. KIMBELL. I would certainly be willing to invite the President of the United States to come visit some national forests with me and some of my expert staff to look at the health of forests across the United States.

Mr. INSLEE. I am thrilled by that. I hope you will do so, and I hope you will let us know what the President's response is, because we need his help to solve these problems these forests have.

Thank you for that.

As far as what is happening to cause these forest fires, I wanted to put in the record, Mr. Chair, an article by Dr. Al Westerling and several others from the University of California at Scripps, that basically looked at the fire.

This came out in Science Express on July 6, 2006. And they looked at these records and they found that the greatest increases in the fires were in the mid-elevation northern Rockies forest where land use histories have relatively little effect on fire risks and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt. That is an abstract of this article.

Basically what this article suggests is that the huge increase in forest fires we are experiencing are probably more associated with climate change than anything else, of increased spring and summer temperatures and earlier spring snowmelt for drier forests.

Now that, to me, means that even if we do better serve a culture, it means that our forests are going to die.

So I appreciate your offer. I am going to follow up with you.

[The information follows:]

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Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity

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Western United States forest wildfire activity is widely thought to have increased in recent decades, yet neither the extent of recent changes nor the degree to which climate may be driving regional changes in wildfire has been systematically documented. Much of the public and scientific discussion of changes in western United States wildfire has focused instead on the effects of 19th- and 20th-century land-use history. We compiled a comprehensive database of large wildfires in western United States forests since 1970 and compared it with hydroclimatic and land-surface data. Here, we show that large wildfire activity increased suddenly and markedly in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons. The greatest increases occurred in mid-elevation, Northern Rockies forests, where land-use histories have relatively little effect on fire risks and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt.

Wildfires have consumed increasing areas of western U.S. forests in recent years, and fire-fighting expenditures by federal land-management agencies now regularly exceed US$1 billion/year (*1*). Hundreds of homes are burned annually by wildfires, and damages to natural resources are sometimes extreme and irreversible. Media reports of recent, very large wildfires (>100,000 ha) burning in western forests have garnered widespread public attention, and a recurrent perception of crisis has galvanized legislative and administrative action (*1*–*3*).

Extensive discussions within the fire-management and scientific communities and the media seek to explain these phenomena, focusing on either land-use history or climate as primary causes. If increased wildfire risks are driven primarily by land-use history, then ecological restoration and fuels management are potential solutions. However, if increased risks are largely due to changes in climate during recent decades, then restoration and fuels treatments may be relatively ineffective in reversing current wildfire trends (*4*, *5*). We investigated 34 years of western U.S. (hereafter, "western") wildfire history together with hydroclimatic data to determine where the largest increases in wildfire have occurred and to evaluate how recent climatic trends may have been important causal factors.

Competing explanations: Climate versus management. Land-use explanations for increased western wildfire note that extensive livestock grazing and increasingly effective fire suppression began in the late 19th and early 20th centuries, reducing the frequency of large surface fires (*6*–*8*). Forest regrowth after extensive logging beginning in the late 19th century, combined with an absence of extensive fires, promoted forest structure changes and biomass accumulation, which now reduce the effectiveness of fire suppression and increase the size of wildfires and total area burned (*3*, *5*, *9*). The effects of land-use history on forest structure and biomass accumulation are, however, highly dependent upon the "natural fire regime" for any particular forest type. For example, the effects of fire exclusion are thought to be profound in forests that previously sustained frequent, low-intensity surface fires [such as Southwestern ponderosa pine and Sierra Nevada mixed conifer (*2*, *3*, *10*, *11*)], but of little or no consequence in forests that previously sustained only very infrequent, high-severity crown fires (such as Northern Rockies lodgepole pine or spruce-fir (*1*, *5*, *12*)].

In contrast, climatic explanations posit that increasing variability in moisture conditions (wet/dry oscillations promoting biomass growth, then burning), and/or a trend of increasing drought frequency, and/or warming temperatures have led to increased wildfire activity (*13*, *14*). Documentary records and proxy reconstructions (primarily from tree rings) of fire history and climate provide evidence that western forest wildfire risks are strongly positively associated with drought concurrent with the summer fire season and (particularly in ponderosa pine–dominant forests) positively associated to a lesser extent with moist conditions in antecedent years (*13*–*18*). Variability in western climate related to the Pacific Decadal Oscillation and intense El Niño/La Niña events in recent decades along with severe droughts in 2000 and 2002 may have promoted greater forest wildfire risks in areas such as the Southwest, where precipitation anomalies are significantly influenced by patterns in Pacific sea surface temperature (*19*–*22*). Although corresponding decadal-scale variations and trends in climate and wildfire have been identified in paleo studies, there is a paucity of evidence for such associations in the 20th century.

We describe land-use history versus climate as competing explanations, but they may be complementary in some ways. In some forest types, past land uses have probably increased the sensitivity of current forest wildfire regimes to climatic variability through effects on the quantity, arrangement, and continuity of fuels. Hence, an increased incidence of large, high-severity fires may be due to a combination of extreme droughts and overabundant fuels in some forests. Climate, however, may still be the primary driver of forest wildfire risks on interannual to decadal scales. On decadal scales, climatic means and variability shape the character of the vegetation [e.g., species populations and their drought tolerance (*23*) and biomass (fuel) continuity (*24*), thus also affecting fire regime responses to shorter term climate variability]. On interannual and shorter time scales, climate variability affects the flammability of live and dead forest vegetation (*13*–*19*, *25*).

High-quality time series are essential for evaluating wildfire risks, but for various reasons (*26*), previous works have not rigorously documented changes in large-wildfire frequency for

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western forests. Likewise, detailed fire-climate analyses for the region have not been conducted to evaluate what hydroclimatic variations may be associated with recent increased wildfire activity, and the spatial variations in these patterns.

We compiled a comprehensive time series of 1166 large (>400 ha) forest wildfires for 1970 to 2003 from federal land-management units containing 61% of western forested areas (and 80% above 1370 m) (*26*) (fig. S1). We compared these data with corresponding hydroclimatic and land surface variables (*26–34*) to address where and why the frequency of large forest wildfire has changed.

Increased forest wildfire activity. We found that the incidence of large wildfires in western forests increased in the mid-1980s (Fig. 1) [hereafter, "wildfires" refers to large-fire events (>400 ha) within forested areas only (*26*)]. Subsequently, wildfire frequency was nearly four times the average of 1970 to 1986, and the total area burned by these fires was more than six and a half times its previous level. Interannual variability in wildfire frequency is strongly associated with regional spring and summer temperature (Spearman's correlation of 0.76, $P < 0.001$, $n = 34$). A second-order polynomial fit to the regional temperature signal alone explains 66% of the variance in the annual incidence of these fires, with many more wildfires burning in hotter than in cooler years.

The length of the wildfire season also increased in the 1980s (Fig. 1). The average season length (the time between the reported first wildfire discovery date and the last wildfire control date) increased by 78 days (64%), comparing 1970 to 1986 with 1987 to 2003. Roughly half of that increase was due to earlier ignitions, and half to later control (48% versus 52%, respectively). Later control dates were no doubt partly due to later ignition dates, given that the date of the last reported wildfire ignition increased by 15 days, but a substantial increase in the length of time the average wildfire burned also played a role. The average time between discovery and control for a wildfire increased from 7.5 days from 1970 to 1986 to 37.1 days from 1987 to 2003. The annual length of the fire season and the average time each fire burned were also moderately correlated with the regional spring and summer temperature (Spearman's correlations of 0.61 ($P < 0.001$) and 0.55 ($P < 0.001$), respectively.

The greatest increase in wildfire frequency has been in the Northern Rockies, which account for 60% of the increase in large fires. Much of the remaining increase (18%) occurred in the Sierra Nevada, southern Cascades, and Coast Ranges of northern California and southern Oregon ("Northern California," in fig. S2). The Pacific Southwest; the Southern Rockies; the Northwest; coastal, central, and southern California; and the Black Hills each account for 11%, 5%, 5%, <1%, and <1%, respectively. Interestingly, the Northern Rockies and the Southwest show the same trend in wildfire frequency relative to their respective forested areas. However, the Southwest's absolute contribution to the western regional total is limited by its smaller forested area relative to higher latitudes.

Increased wildfire frequency since the mid-1980s has been concentrated between 1680 and 2590 m in elevation, with the greatest increase centered around 2130 m. Wildfire activity at these elevations has been episodic, coming in pulses during warm years, with relatively little activity in cool years, and is strongly associated with changes in spring snowmelt timing, which in turn is sensitive to changes in temperature.

Fire activity and the timing of the spring snowmelt. As a proxy for the timing of the spring snowmelt, we used Stewart and colleagues' dates of the center of mass of annual flow (CT) for snowmelt-dominated streamflow gauge records in western North America (*32–34*). The annual wildfire frequency for the region is highly correlated (inversely) with CT at gauges across the U.S. Pacific Northwest and interior West, indicating a coherent regional signal of wildfire sensitivity to snowmelt timing (Fig. 2).

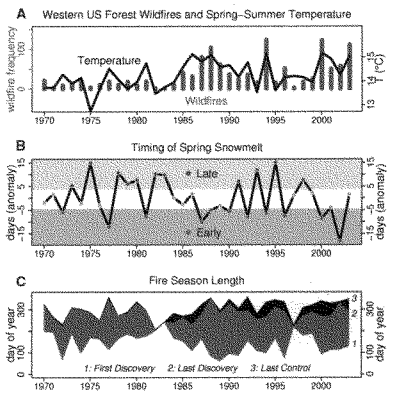

Fig. 1. (**A**) Annual frequency of large (>400 ha) western U.S. forest wildfires (bars) and mean March through August temperature for the western United States (line) (*26*, *30*). Spearman's rank correlation between the two series is 0.76 ($P < 0.001$). Wilcoxon test for change in mean large-forest fire frequency after 1987 was significant ($W = 42$; $P < 0.001$). (**B**) First principle component of center timing of streamflow in snowmelt dominated streams (line). Low (pink shading), middle (no shading), and high (light blue shading) tercile values indicate early, mid-, and late timing of spring snowmelt, respectively. (**C**) Annual time between first and last large-fire ignition, and last large-fire control.

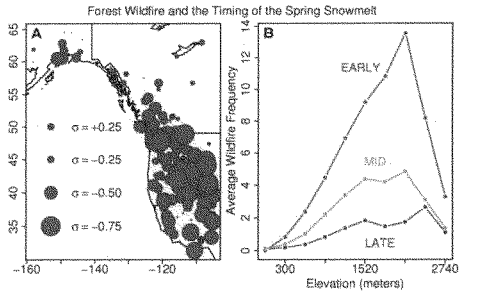

Fig. 2. (**A**) Pearson's rank correlation between annual western U.S. large (>400 ha) forest wildfire frequency and streamflow center timing. *x* axis, longitude; *y* axis, latitude. (**B**) Average frequency of western U.S. forest wildfire by elevation and early, mid-, and late snowmelt years from 1970 to 2002. See Fig. 1B for a definition of early, mid-, and late snowmelt years.

The negative sign of these correlations indicates that earlier snowmelt dates correspond to increased wildfire frequency. Following Stewart *et al.*, we used the first principal component (CT1) of CT at western U.S. streamflow gauges as a regional proxy for interannual variability in the arrival of the spring snowmelt (Fig. 1) (*26*, *32*). This signal had its greatest impact on wildfire frequency between elevations of 1680 and 2590 m (Fig. 2), with a nonlinear response at these elevations to variability in snowmelt timing. Overall, 56% of wildfires and 72% of area burned in wildfires occurred in early (i.e., lower tercile CT1) snowmelt years, whereas only 11% of wildfires and 4% of area burned occurred in late (i.e., upper tercile CT1) snowmelt years.

Temperature affects summer drought, and thus flammability of live and dead fuels in forests through its effect on evapotranspiration and, at higher elevations, on snow. Additionally, warm spring and summer temperatures were strongly associated with reduced winter precipitation over much of the western United States (Fig. 3). The arrival of spring snowmelt in the mountains of the western United States, represented here by CT1, is strongly associated with spring temperature (*26*). Average spring and summer temperatures throughout the entire region are significantly higher in early than in late years (Fig. 3), peaking in April. The average difference between early and late April mean monthly temperatures in forested areas was just over 2°C, and it increased with elevation.

Snow carries over a substantial portion of the winter precipitation that falls in western mountains, releasing it more gradually in late spring and early summer, providing an important contribution to spring and summer soil moisture (*33*). An earlier snowmelt can lead to an earlier, longer dry season, providing greater opportunities for large fires due both to the longer period in which ignitions could potentially occur and to the greater drying of soils and vegetation. Consequently, it is not surprising that the incidence of wildfires is strongly associated with snowmelt timing.

Changes in spring and summer temperatures associated with an early spring snowmelt come in the context of a marked trend over the period of analysis. Regionally averaged spring and summer temperatures for 1987 to 2003 were 0.87°C higher than those for 1970 to 1986. Spring and summer temperatures for 1987 to 2003 were the warmest since the start of the record in 1895, with 6 years in the 90th percentile—the most for any 17-year period since the start of the record in 1895 through 2003—whereas only 1 year in the preceding 17 years ranked in the 90th percentile. Likewise, 73% of early years since 1970 occurred in 1987 to 2003 (Fig. 1).

Spatial variability in the wildfire response to an earlier spring. Vulnerability of western U.S. forests to more frequent wildfires due to warmer temperatures is a function of the spatial distribution of forest area and the sensitivity of the local water balance to changes in the timing of spring. We measured this sensitivity using the October-to-September moisture deficit—the cumulative difference between the potential evapotranspiration due to temperature and the actual evapotranspiration constrained by available moisture—which is an important indicator of drought stress in plants (*24*). We used the percentage difference in the moisture deficit for early versus late snowmelt years scaled by the fraction of forest cover in each grid cell to map forests' vulnerability to changes in the timing of spring (Fig. 4) (*26*). The Northern Rockies and Northern California display the greatest vulnerability by this measure—the same forests accounting for more than three-quarters of increased wildfire frequency since the mid-1980s. Although the trend in temperature over the Northern Rockies increases with elevation, vulnerability in the Northern Rockies is highest around 2130 m, where the greatest increase in fires has occurred. At lower elevations, the moisture deficit in early years is increasing from a high average value (i.e., summer drought tends to be longer and more intense at lower elevations), whereas at higher elevations the longer dry season in early years is still relatively short, and vegetation is somewhat buffered from the effects of higher temperatures by the available moisture.

Discussion. Robust statistical associations between wildfire and hydroclimate in western forests indicate that increased wildfire activity over recent decades reflects sub-regional responses to changes in climate. Historical wildfire observations exhibit an abrupt transition in the mid-1980s from a regime of infrequent large wildfires of short (average of 1 week) duration to one with much more frequent and longer burning (5 weeks) fires. This transition was

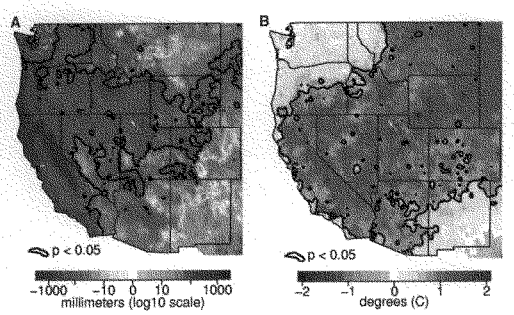

Fig. 3. Average difference between early and late snowmelt years in average precipitation from October through May (**A**) and average temperature from March through August (**B**). Contours enclose regions in which a *t* test for the difference in mean between 11 early and 11 late years was significant ($P < 0.05$). The null hypothesis that precipitation from October through May is normally distributed could not be rejected using the Shapiro-Wilk test for normality ($P > 0.05$ for more than 95% of 24,170 grid cells, $n = 49$ for precipitation; $P > 0.05$ for more than 95% of 24,170 grid cells, $n = 50$ for temperature). See Fig. 1B for a definition of early, mid-, and late snowmelt years.

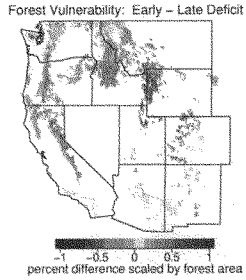

Fig. 4. Index of forest vulnerability to changes in the timing of spring: the percentage difference in cumulative moisture deficit from October to August at each grid point in early versus late snowmelt years, scaled by the forest-type vegetation fraction at each grid point, for 1970 to 1999 (*26*). See fig. S3 for a map of forest vulnerability for 1970 to 2003 over a smaller spatial domain. See Fig. 1B for a definition of early, mid-, and late snowmelt years.

marked by a shift toward unusually warm springs, longer summer dry seasons, drier vegetation (which provoked more and longer burning large wildfires), and longer fire seasons. Reduced winter precipitation and an early spring snowmelt played a role in this shift. Increases in wildfire were particularly strong in mid-elevation forests.

The greatest absolute increase in large wildfires occurred in Northern Rockies forests. This sub-region harbors a relatively large area of mesic, middle and high elevation forest types (such as lodgepole pine and spruce-fir) where fire exclusion has had little impact on natural fire regimes (*1*, *5*), but where we found that an advance in spring produces a relatively large percentage increase in cumulative moisture deficit by midsummer. In contrast, changes in Northern California forests may involve both climate and land-use effects. In these forests, large percentage changes in moisture deficits were strongly associated with advances in the timing of spring, and this area also includes substantial forested area where fire exclusion, timber harvesting, and succession after mining activities have led to increased forest densities and fire risks (*10*, *11*). Northern California forests have had substantially increased wildfire activity, with most wildfires occurring in early years. Southwest forests, where fire exclusion has had the greatest effect on fire risks (*2*, *3*), have also experienced increased numbers of large wildfires, but the relatively small forest area there limits the impact on the regional total, and the trend appears to be less affected by changes in the timing of spring. Most wildfires in the Southern Rockies and Southern California have also occurred in early snowmelt years, but again forest area there is small relative to the Northern Rockies and Northern California. Thus, although land-use history is an important factor for wildfire risks in specific forest types (such as some ponderosa pine and mixed conifer forests), the broad-scale increase in wildfire frequency across the western United States has been driven primarily by sensitivity of fire regimes to recent changes in climate over a relatively large area.

The overall importance of climate in wildfire activity underscores the urgency of ecological restoration and fuels management to reduce wildfire hazards to human communities and to mitigate ecological impacts of climate change in forests that have undergone substantial alterations due to past land uses. At the same time, however, large increases in wildfire driven by increased temperatures and earlier spring snowmelts in forests where land-use history had little impact on fire risks indicates that ecological restoration and fuels management alone will not be sufficient to reverse current wildfire trends.

These results have important regional and global implications. Whether the changes observed in western hydroclimate and wildfire are the result of greenhouse gas–induced global warming or only an unusual natural fluctuation is beyond the scope of this work. Regardless of past trends, virtually all climate-model projections indicate that warmer springs and summers will occur over the region in coming decades. These trends will reinforce the tendency toward early spring snowmelt (*36*, *37*) and longer fire seasons. This will accentuate conditions favorable to the occurrence of large wildfires, amplifying the vulnerability the region has experienced since the mid-1980s. The Intergovernmental Panel on Climate Change's consensus range of 1.5° to 5.8°C projected global surface temperature warming by the end of the 21st century is considerably larger than the recent warming of less than 0.9°C observed in spring and summer during recent decades over the western region (*37*).

If the average length and intensity of summer drought increases in the Northern Rockies and mountains elsewhere in the western United States, an increased frequency of large wildfires will lead to changes in forest composition and reduced tree densities, thus affecting carbon pools. Current estimates indicate that western U.S. forests are responsible for 20 to 40% of total U.S. carbon sequestration (*38*, *39*). If wildfire trends continue, at least initially, this biomass burning will result in carbon release, suggesting that the forests of the western United States may become a source of increased atmospheric carbon dioxide rather than a sink, even under a relatively modest temperature-increase scenario (*38*, *39*). Moreover, a recent study has shown that warmer, longer growing seasons lead to reduced CO_2 uptake in high-elevation forests, particularly during droughts (*40*). Hence, the projected regional warming and consequent increase in wildfire activity in the western United States is likely to magnify the threats to human communities and ecosystems, and substantially increase the management challenges in restoring forests and reducing greenhouse gas emissions.

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Supporting Online Material

www.sciencemag.org/cgi/content/full/1128834/DC1
Materials and Methods
Figs. S1 to S3
References

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Include this information when citing this paper.

The CHAIRMAN. We just have time to also recognize the gentleman from Mississippi, Mr. Cleaver, for his 5 minutes of questions.

Mr. CLEAVER. Thank you, Mr. Chairman, and the Chief for your questions here.

We are running late so we—a number of us went to Greenland a few weeks ago and painfully listened to some Greenlanders talk about how indigenous fish were leaving the area in a search for colder waters.

And listening to you, you didn't quite get there, but are there certain species of birds that are now going further and further northward, maybe even into Canada, because they—the warming climate is not conducive to reproduction and hunting and so forth?

Ms. KIMBELL. We have very good evidence that there are a number of birds that are changing their use patterns, changing their habits. Fish, we are very concerned about. It has been estimated that a 2-degree temperature rise in the waters that support many of our trout fisheries would no longer be able to—if there were a 2-degree rise, would no longer be able to support those trout.

So we are very concerned about all of that and have been studying it.

Grizzly bears in the Yellowstone ecosystem have used for decades the seeds from whitebark pine. Well, whitebark pine is moving higher and higher in elevation, and those lower in elevation are no longer thriving; and we are very concerned about that, and we have been studying that.

So these are all pieces of the climate change picture that we do have science resources assigned to; and we need to learn more about it.

Mr. CLEAVER. I was recently in Aspen, and they killed 12 bears over the summer. Bears who are now coming down into the city because of the bark and the inaccessibility of their food, and so where it is creating a conflict with humans, it will result in some killings.

I think I probably should go vote since——

Ms. KIMBELL. We could talk all day about grizzly bears, and I did get to Missouri this summer as well, and you have got some beautiful country on the Mark Twain Forest.

Mr. CLEAVER. God bless you.

The CHAIRMAN. And he is actually a Reverend, so that means something. From an ordinary member, it would mean nothing.

So we thank you very much, Chief Kimbell, for your excellent testimony; and we look forward to working with you right in the future.

We have three roll calls on the floor of the House. We will take a brief recess, and we will return in about 20 minutes.

[Recess.]

The CHAIRMAN. The hearing is reconvened and our very distinguished second panel will now be recognized.

First, I will ask Dr. Steven Running who is a distinguished forest ecologist who has published over 240 scientific articles. As a chapter lead author for the Fourth Assessment report of the Intergovernmental Panel on Climate Change, Dr. Running shares the recently announced Nobel Peace Prize with his colleagues.

And we extend our congratulations to you.

He is a professor at the University of Montana and a Fellow of the American Geophysical Union, and he is a recognized expert on climate modeling and specifically on the impacts of climate change in North America.

So we welcome you, Doctor. Whenever you are ready, please begin.

STATEMENT OF DR. STEVEN RUNNING, PROFESSOR OF ECOLOGY, UNIVERSITY OF MONTANA

Mr. RUNNING. Good morning, Chairman Markey, and members of this Select Committee.

I thank you for the opportunity to come and testify on wildfire and climate change; and I think what I want to do, rather than going through much of my prepared discussion, which has been covered at length this morning, I want to really focus on a couple of issues that I think are particularly important for this committee to understand.

And so, first, for the record, as an IPCC author, let me read the exact text that I put in the IPCC report.

"Since 1980, an average of 22,000 kilometers squared per year has burned in U.S. wildfires, almost twice the average from 1920 to 1980. The forested area burned in the Western U.S. from 1987 to 2003 is 6.7 times the area burned from 1970 to 1986.

"The wildfire burned area in the North American boreal region has increased from 6,500 square kilometers per year in the 1960s to 29,700 square kilometers per year in the 1990s."

And as of October 29th, we have now burned 8.7 million acres of land in the U.S. this year.

So these are the statistics I put in the IPCC report, and I think what I want to do is just make two critical points for the time that we have here.

When we look at the causes, what is causing this real acceleration in wildfire?

There are four important trends that we are aware of: Clearly, our forests and rangeland have grown back over the last century from overgrazing and overlogging in the 1800s. So some of this is a natural ecological recovery.

We add to that a second factor of the fire suppression, and we have already heard about that from the Chief earlier this morning. Ninety-eight percent of the fires are now suppressed. So we really have ecosystems throughout the country that are growing back to a point where they have actually overgrown the carrying capacity of the landscape.

And a fire is a natural way for an ecosystem to return to its natural equilibrium, and we have taken that away by suppressing the fires.

So, in a way, you might think that our ecosystems have overshot the climate that would support the forests, particularly in the West.

I want to make then the second point of how important snowmelt and snowpack is for all of the northern forests.

Obviously, snow is a natural fire retardant. When there is snow on the ground, nothing is going to burn, and we now see snow melting 1 to 4 weeks earlier than we did 50 years ago. That is not

only lengthening the fire season, but it is bringing forests at higher elevations into a vulnerable condition of drought. That didn't used to happen, just literally because there was snow on the ground. So the acceleration of wildfire in the wild western forests is very much a function of this early snowmelt.

The last point I want to make is where the future is going. And before IPCC, there were over a dozen climate models run hundreds of different times. In my written testimony, on figure 4, I showed the results of what all of these GCMs project for the future.

And I summarized just a single graph to save time, and basically that one graph, this is a consensus of seven different GCMs, is that western North America summertime temperatures will be 3 to 5 degrees centigrade warmer than they are now. And in about 50 years——

The CHAIRMAN. Which translates in Fahrenheit to?

Mr. RUNNING. To about 5 to 8 degrees Fahrenheit warmer in 8 years. And the important point is, there will be no increases in precipitation.

So I can only conclude from the best GCMs run for the IPCC report that the Western U.S. is in for longer, hotter summers, and I can conclude nothing else but that is going to increase wildfire dynamics.

So with that, my time is up. And those are the key points I want to make.

The CHAIRMAN. So it is 5 to 8 degrees warmer and no more rain over the next 50 years.

[The statement of Mr. Running follows:]

Testimony of
Dr. Steven W. Running
Before the House Select Committee on Energy Independence and Global Warming
Hearing on Wildfires and the Climate Crisis
November 1, 2007

Chairman Markey, Ranking Member Sensenbrenner, and Members of this Select Committee, I thank you for the opportunity to testify on matters of wildfires and climate change today. My name is Steven W. Running, Professor of Ecology at the University of Montana in Missoula, MT. I have lived in Washington, Oregon, Colorado and Montana, so have high familiarity with forests of the West. My research for nearly forty years has been on forest stress, terrestrial carbon and water cycles, and satellite monitoring of global ecosystem health. Most important to this committee, I recently served as a Lead Author on the Intergovernmental Panel on Climate Change 4th Assessment that was co-recipient of the 2007 Nobel Peace Prize. My responsibility was in the Working Group II Chapter 14 on North American impacts, and my text specifically concerned trends in North American wildfire.

Executive Summary

The summary points of my testimony are:

1. Wildfire activity in the U.S. including Alaska, has increased dramatically in the last few decades, and correlates directly with recent warming and drying trends, and earlier mountain snowmelt.
2. Fuel accumulations due to past fire suppression and grazing control combine with climate trends to explain recent unprecedented wildfire intensities and patterns.
3. Global climate model runs used for the 4th IPCC Assessment predict even warmer and drier summers for the western U.S. in the next 50 years.
4. These climatic warming trends will exacerbate natural drought cycles, and stressed ecosystems will inevitably burn, human adaptation is essential.
5. Construction standards to encourage limited combustion building design and materials, fire defensible perimeters around structures, and zoning are necessary to cope with inevitable wildfires.
6. Fuel reduction efforts of removing small trees and surface fuels, processed to biomass for institutional heating, could both reduce wildfire risk and substitute for some fossil fuel consumption.

CURRENT WILDFIRE TRENDS

Let me first summarize, with text paraphrased directly from the IPCC report, WG II Chapter 14, what we know about current wildfire trends in North America.

Since 1980, an average of 22,000 km^2/yr has burned in U.S. wildfires, almost twice the 1920 to 1980 average of 13,000 km^2/yr (Schoennagel et al., 2004). The forested area burned in the western U.S. from 1987 to 2003 is 6.7 times the area burned from 1970 to 1986 (Westerling et al., 2006). In Canada, burned area has exceeded 60,000 km^2/yr three

times since 1990, twice the long-term average (Stocks et al., 2002). Wildfire-burned area in the North American boreal region increased from 6,500 km^2/yr in the 1960s to 29,700 km^2/yr in the 1990s (Kasischke and Turetsky, 2006). Human vulnerability to wildfires has also increased, with a rising population in the wildland-urban interface.

And as of Oct 29, 8.7 million acres have now burned in 2007 (see Fig 1). Note that the graphics ended on October 5, because normally the fire season would be over. Yet California burned 380,000 acres last week. The 10-year annual average of 5.9 million acres burned has been exceeded six times since 2000.

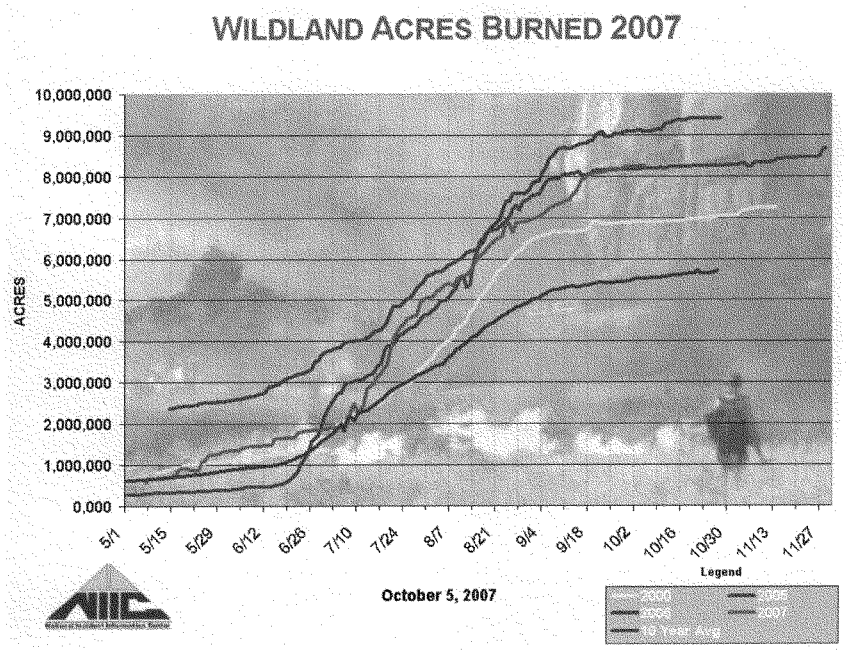

Figure 1: Seasonal trend of U.S. wildfire area. Note that when the graph starts, May 1, the SE fire season has often already burned a few hundred thousand acres in Spring fires.

THE CAUSES

In my view, ***four important trends*** have combined to bring us to the wildfire emergency we have today. ***First***, our western landscapes particularly are recovering from the stunning overexploitation of the 19th century, when unrestrained logging and overgrazing denuded much of the western landscape. Current forestland is much more extensive now than 100 years ago, and some invasive species like cheatgrass are highly ignitable when

dry. Historical photographs illustrate rather denuded landscapes in the interior West around the turn of the 20th century that has recovered and regrown (Figure 2).

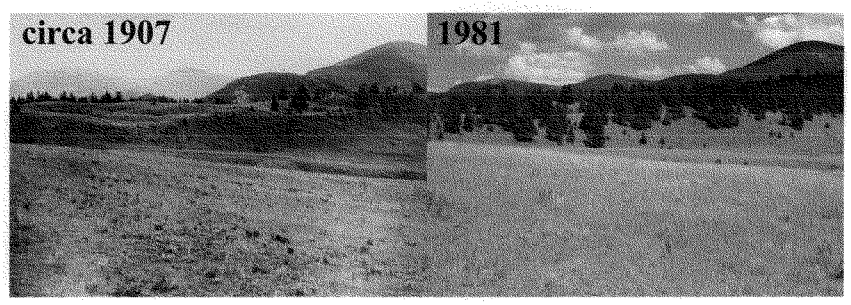

FIGURE 2. Flint Creek Range in western Montana

Second, wildfire suppression was organized nationally after the cataclysmic wildfires in 1910 that burned 2.6 million acres of national forest land in Idaho-Montana, including over 4700 square miles in 2 Days during the Big Blowup that killed 88 people. The Big Blowup was a "Perfect Storm" when all the weather and fuel wildfire ingredients merged with a massive 2 day windstorm on August 20-21, 1910, generating 80mph winds and blowing firebrands 10 miles ahead (Pyne 2001). These low probability, high impact events will always happen occasionally despite anything humans do. For the succeeding 100 years it was the goal of wildfire managers to suppress every fire before 10AM the following morning. In fact, wildland fire fighters now suppress successfully about 98% of all unplanned ignitions, a very high success rate! Unfortunately, the 2% that cannot be successfully suppressed occur under extreme conditions of fire growth brought on by extremely hot, dry weather, and in almost every case, wind velocities above 30mph. In these fire weather conditions, as we witnessed last week with the Santa Ana winds in California, a new fire can grow within hours to a level where no amount of manpower, equipment and money can stop it. These massive wildfires can have energy releases the equivalent of a Hiroshima atom bomb exploding every 10 minutes. Until the weather, particularly wind, subsides nothing can be done to stop these most dangerous fires except evacuate people.

The ***third*** important trend is the large number of dwellings and structures that have been built in forested area, particularly in the last 30 years. The wildland urban interface nationally now is an area larger than the size of California, and an estimated 8 million homes have been built in this interface since1970. In recent years many western states have experienced loss of hundreds of homes from wildfires, Colorado and Arizona in 2002, California in 2003, Texas in 2006. In addition, thousands of cabins, houses and ranches have been built in rural forested areas since the 1970s, typically as recreational second homes. A wildfire that might have burned harmlessly many miles from any human settlement now is threatening structures almost immediately. Wildfire suppression often must concentrate on public safety and structure protection, not putting out the fire.

Since 2000, the number of human-caused fires in the U.S. has ranged from 50 to 80 thousand per year, far outnumbering lightning caused fires at 8 – 16 thousand per year. Human caused fires occur from accidents, carelessness, and arson. Millions of Americans picnic and camp in the western forests every summer, so limiting these ignitions is challenging. However lightning-caused fires usually burn >60% of the annual total area, because fires in limited access areas are more difficult to attack, or may be allowed to burn to reintroduce natural fire cycles in remote areas where danger to the public is not great.

The ***fourth*** and final important trend is the changing climate. Again from the IPCC report, WGII, Chapter 14:

A warming climate encourages wildfires through a longer summer period that dries fuels, promoting easier ignition and faster spread (Running, 2006). Westerling et al. (2006) found that in the last three decades the wildfire season in the western U.S. has increased by 78 days, and burn durations of fires >1000 ha in area have increased from 7.5 to 37.1 days, in response to a spring-summer warming of 0.87°C. Earlier spring snowmelt has led to longer growing seasons and drought, especially at higher elevations, where the increase in wildfire activity has been greatest, see Fig 1 (Westerling et al., 2006). In Canada, warmer May to August temperatures of 0.8°C since 1970 are highly correlated with area burned (Gillett et al., 2004). In the south-western U.S., fire activity is correlated with El Niño-Southern Oscillation (ENSO) positive phases (Kitzberger et al., 2001; McKenzie et al., 2004), and higher Palmer Drought Severity Indices.

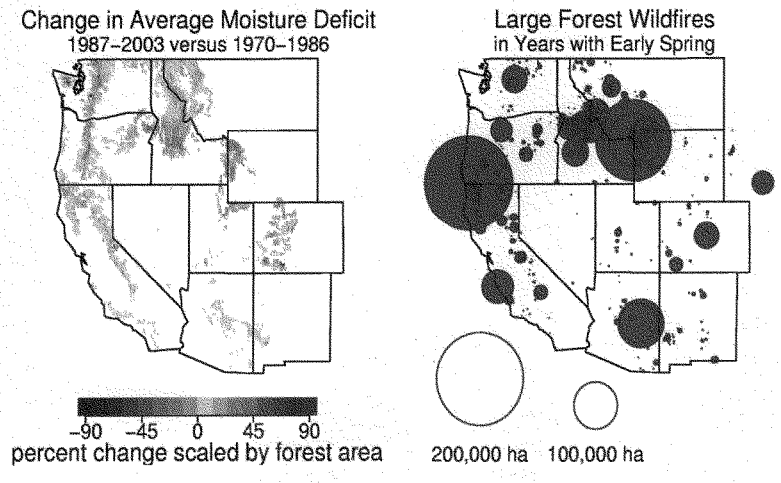

FIGURE 3. Between 1970 and 2003, spring-summer moisture availability declined in many forests in the western U. S. and most major wildfires exceeding 1000ha occurred in these same droughted areas. (From Running, 2006, Westerling et al 2006)

The mountains of the West carry most of the regional forest cover, as the valleys are often too dry or have been cleared for farming and ranching. These rather arid western forests rely predominantly on snowpack for their water supply for growth and survival, as summer rainfall is sporadic and re-evaporates quickly. Snowpack are now melting 2-4 weeks earlier throughout much of the West (Mote et al 2003), extending the summer dry period in time, *and* extending up in elevation the vulnerable dry forest area.

Ecosystems have a carrying capacity for vegetation, much like rangeland has a carrying capacity for cattle, or even an airplane for passengers. A parcel of land can only supply a finite amount of light, water and nutrients to the plants, yet many more plants germinate and compete for these resources than can permanently be sustained. When this climatic carrying capacity is exceeded, the vegetation, cattle or passengers don't immediately die, they initially become stressed, and more vulnerable to small, otherwise normal perturbations of their systems. Insects and diseases are a natural part of ecosystems. In forests, periodic insect epidemics kill stressed trees over large regions, providing dead, desiccated fuels for large wildfires (Logan et al., 2003). Ironically, fires have had the primary natural role of keeping ecosystems healthy in the arid western forests by cleaning out dead material and keeping the vegetation at or below the climatic carrying capacity of the landscape. During a hot, dry summer, when the carrying capacity of water to the ecosystem is reduced, fires react by reducing the vegetation cover. We now are entering an era where the ecosystem water supply may be permanently reduced, and ultimately the natural ecosystems will rebalance to this new climate. New ecosystems that grow back after fires may be different from the ecosystem that burned.

The Southeast U.S. is thought to be a mesic climate, yet because those ecosystems are accustomed to high normal rainfall, drought cycles rapidly deplete water availability. Spring is typically the most active fire season, before summer monsoon rains begin, and recent years have had major wildfires in Florida, Georgia and Texas.

Fires on Alaska's North Slope have been considered rare events. Only 134 fires north of 68° are recorded in fire history kept by the Alaska Fire Service since 1956. The 2007 Anaktuvuk River fire was an unprecedented event in that it burned in September, was so large (256,000 acres), and that it burned all the way from the coastal plain to the foothills of the Brooks Range.

FUTURE CLIMATE TRENDS

Our best look into the future climate is from analyzing the extensive computer model runs done for the 4th IPCC Assessment. Seven different global circulation models or GCMs from 6 countries were operated for three future emission scenarios, and selected for detailed regional analysis (Ruosteenoja et al 2003). A summary of these results for the western U.S. suggests that within 50 years the summer-time temperatures will be 3-4 deg C (5-7deg F) warmer, but with equal or even less precipitation than the present. Seaver et al (2007) analyzing 19 climate models for the IPCC report concluded that the Southwest U.S. may have a permanent Dust Bowl climate, which ironically would decrease fires in some areas due to lack of fuel.

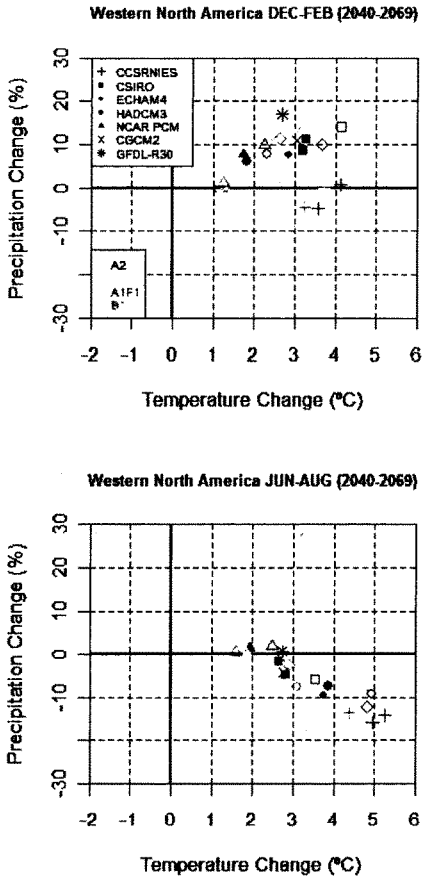

Figure 4: GCM runs done for the 4th IPCC Assessment report. These graphs isolate the western North America region, for the 2040-2069 time period, and show expected precipitation and temperature for the winter months (top) and summer months (bottom). Models included are the CCSRN (Japan), CSIRO (Australia), ECHAM (Germany), HADCM3 (United Kingdom), NCARPCM (U.S.A.), CGCM2 (Canada), GFDL-R30 (U.S.A.). A@, A1F1, B2 refer to IPCC Emission scenarios used for the 4th Assessment climate simulations. (from Ruosteenoja et al. 2003).

Implications for the future of wildfire in the West are clear. Warmer summer temperatures are projected to extend the annual window of high fire ignition risk by 10-30%, and could result in increased area burned of 74-118% in Canada by 2100 (Brown et al., 2004; Flannigan et al., 2004). The ecosystems that return after fire will not

necessarily be the same that burned, but will be a more arid type. Closed canopy forests may be replaced with open savannahs. Analysis of recent satellite data by Wentz et al (2007), concludes that dry climates will get drier in the future, and the pattern is already emerging in current data.

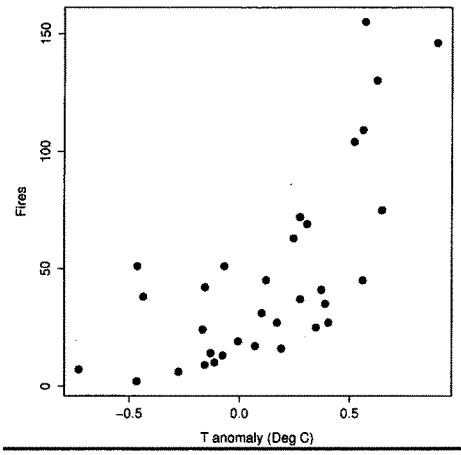

Figure 5: Large fires (>500acres) from 1972-2004 in the forested West related to March-August temperature anomaly. Note that these data only range to a temperature anomaly of 0.7deg, while Figure 4 projects temperature increases of 3-5 degrees by the 2050s. (from T. Westerling).

POTENTIAL SOLUTIONS

I defer detailed solutions to the land and fire management professionals also testifying today, but wish to make a few observations. When "Perfect Firestorm" conditions develop, as in California last week, the emphasis should of course be on human safety, and the public needs to understand that effective fire suppression must wait until the extreme weather conditions subside.

Combining the four trends identified earlier together, I can only conclude that the U.S. can expect more wildfire in coming decades. Consequently, I think building construction standards in fire prone areas need to emphasize fire resistance. Maintaining defensible space of 100ft around each home in fire risk localities needs to be a priority. There may need to be zoning regulations in some areas, focused on fire adaptation. Also, each homeowner in vulnerable areas has the responsibility to follow the well-publicized Fire Wise procedures for regularly minimizing combustion risk on their property. These may sound heavy-handed, but it is public funding that is used to fight these fires.

However, fire is not always the enemy. Fire has an important ecological role in keeping vegetation at the climatic carrying capacity of the land. Rather than waiting for hot, dry

years to provide natural fires, it is safer to plan controlled prescribed fire where appropriate that can be accomplished during moderate, not extreme, weather conditions. In the arid West, where dead trees may not decompose for centuries, fire is an important natural recycling system for carbon. However, these fires emit around 5-10% of the CO_2 emitted by fossil fuel combustion in the U.S. (Sue Conard, U.S.F.S.). Policies that would encourage transforming these fire fuels instead to a biomass source for building heating or electrical generation could accomplish the dual objectives of reducing wildfire risk and reducing fossil fuel consumption.

Programs such as the USFS Fuels for Schools are a good example of pursueing the dual objectives of reducing fire fuels in the forest and replacing fossil fuels in town. This Forest Service program proposed to the Western Governors Association that by 2012 a goal of 70 institutional heating facilities be converted to biomass fuels. The program estimates that institutional and governmental buildings with available biomass sources within 60 miles could consume 800,000 tons of biomass per year, and save $90 million/year in fossil fuel costs by 2012 if outfitted with high-efficiency furnaces.

Members of the Association for Fire Ecology adopted ***The San Diego Declaration on Climate Change and Fire Management*** at the 3rd International Fire Ecology and Management Congress held in San Diego, California Nov. 13-17, 2006. The document was drafted by the AFE Board, submitted for peer review and group discussion, and individually endorsed by about 200 Congress participants. This ***Declaration*** states that future land management activities must consider climate change, and recommends a wide range of alternatives for planning and management to enhance ecosystem resiliency to wildland fire in a changing global climate. Recommendations include incorporating the likelihood of more severe fire weather, lengthened wildfire seasons, and larger-sized fire when planning and budgeting, expanding prescribed burning for fuel reduction, controlling highly flammable invasive species, and removing and utilizing small diameter forest products (engineered lumber, pulp, paper, and bio-fuels) and chipped fuels (for electrical energy generation) to reduce fire hazards in appropriate vegetation types. [http://www.fireecology.net/pdfs/san_diego_declaration_final_29_nov_2006.pdf].

SOME FINAL PHILOSOPHY, an essay based on my recent public speaking

The 5 Stages of Climate Grief

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The global warming topic seems to now be saturating the media. Newspapers, television, weekly magazines and endless Internet sites all have summaries of the science, and wide ranging discussions of what society should do next. The global warming trends and projections are sobering, even frightening, eliciting puzzling responses from the public.

As a professor and climate scientist at the University of Montana in the U.S.A., I have been giving public lectures on "The Inconvenient Truth for Montana" for at least 5 years, and these speaking engagements occur now almost every week. Also, as a lead author for Chapter 14 of the most recent Intergovernmental Panel on Climate Change (IPCC) WG II report, I wrote about both the level of scientific consensus and uncertainty, for global warming and impacts for North America. My speeches cover the newest evidence of increasing hurricane intensity, larger wildfires, melting glaciers, and sea level rise that are being implicated with climate change. Individual reactions to my presentations are wide-ranging, from anger to depression, and it has been difficult for me to understand this wide spectrum of emotions.

I recently took a fresh look at the widely recognized concepts on the "5 stages of grief" that Elizabeth Kubler-Ross defined back in the 1970s to summarize how people deal differentially with shocking news, such as being informed that they have terminal cancer. It seems that these stages of grief provide a very good analogy to how people are now reacting to the global warming topic, so I have formulated my "5 Stages of Climate Grief" as follows.

The first stage DENIAL, are the people that simply do not believe the science that the Earth is warming, or secondarily that humans are the cause. Despite seeing a 50 year record of global atmospheric CO_2 rising *every year* since 1957, and global air temperatures of the last dozen years in a row being the warmest in a millennium, they dismiss these trends as natural variability. These people see no reason to disturb the status quo. Most people rightfully started at this stage, until presented with convincing evidence. That convincing scientific evidence recently summarized in the 4th IPCC report has, according to opinion polls, dramatically reduced the number of people in Stage 1.

Many people jump directly from DENIAL to Stage 4, but for others, the next Stage 2, is ANGER, and is manifested by wild comments like "I refuse to live in a tree house in the dark and eat nuts and berries". Because of my public speeches, I receive my share of hate mail, including being labeled a "bloviating idiot", from individuals that clearly are incensed at the thought of substantially altering their lifestyle. My local newspaper has frequent letters to the editor from people angry to the point of irrational statements hinting darkly about the potential end of modern civilization.

Stage 3 is BARGAINING. When they reach this stage many people (such as self-righteous radio talk show hosts), who used to be very public deniers of global warming, begin making statements that warming won't be all that bad, it might make a place like Montana "more comfortable". It is true that the building heating requirements for my hometown Missoula have decreased by about 9% since 1950 due to milder winters. At this stage people grasp for the positive news about climate change, such as longer growing seasons, and scrupulously ignore the negative news, more intense droughts and wildfires, and no glaciers in Glacier National Park by 2020. Most importantly, at this stage people are still *not* willing to change lifestyle, or explore energy solutions that are less carbon intensive. They seem willing to ride out this grand global experiment and cope with whatever happens.

Many people at my lectures have now moved to Stage 4, DEPRESSION. They consider the acceleration of annual greenhouse gas emissions, the unprecedented speed of warming, and the necessity for international cooperation for a solution, and see the task ahead to be impossible. On my tougher days I confess to sinking back to Stage 4 myself.

The final stage ACCEPTANCE, are people that acknowledge the scientific facts calmly, and are now exploring solutions to drive down greenhouse gas emissions dramatically, and find non-carbon intensive energy sources. Two factors are important in moving the public from DEPRESSION to this ACCEPTANCE stage. First are viable alternatives to show that reducing greenhouse gas emissions is possible without the end of modern civilization. It is very heartening to see wind turbines, LED lighting, thin film solar and hybrid cars on the market right now, not some vague future hope. Second is visionary national leadership, a "Marshall Plan" level of national focus and commitment, so everyone is contributing, and the lifestyle changes needed are broadly shared, in fact becoming a new norm. Progress on that front has not been good so far. An obvious flaw in this analogy is that many people are simply ignoring the global warming issue, a detachment they cannot achieve when they are personally facing cancer.

It is both welcome and important that some global leaders of the business community, from DuPont, General Electric and WalMart down to the smallest entrepreneurial startups are now strongly pursuing goals of de-carbonized energy, improved efficiency and conservation. Large social changes always unavoidably breed pain for some and new opportunity for others, depending much on how rapidly people react to new realities. We really need most of our political, business and intellectual leaders to reach Stage 5 ACCEPTANCE in order to move forward, as a nation, and as a global citizenry. There is no guarantee that we can successfully stop global warming, but doing nothing given our present knowledge is unconscionable. How otherwise can we look into our grandchildren's eyes?

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The CHAIRMAN. All right. Our next witness is Dr. Michael Medler. Dr. Medler is an expert on fire ecology and wildland firefighting. He is currently a professor of environmental studies at Western Washington University. He is also the President-elect of the Association For Fire Ecology and a member of the Firefighters United for Safety Ethics and Ecology.

Dr. Medler's research focuses on analysis of historical wildfire patterns in the Western United States. He actually was a wildland firefighter during the 1980s in the Willamette National Forest in Oregon and helped fight the historic Yellowstone fires in 1988.

So we thank you. Please begin.

STATEMENT OF DR. MICHAEL MEDLER, ASSOCIATE PROFESSOR OF WESTERN WASHINGTON UNIVERSITY AND PRESIDENT-ELECT OF THE ASSOCIATION FOR FIRE ECOLOGY, REPRESENTING FIREFIGHTERS UNITED FOR SAFETY, ETHICS AND ECOLOGY

Mr. MEDLER. Thank you, Chairman Markey, and members of the committee.

I want to thank you for this opportunity to testify in climate change and fire management.

As you said, I am a President-elect of the Association for Fire Ecology and also a member of the Firefighters United for Safety, Ethics and Ecology. And many of the important scientific points have been made quite well today, but I would like to make some other points, about fire management, in particular, and firefighting.

As you said, I worked as a firefighter in the Forest Service in the 1980s and really cut my teeth at the Yellowstone fires in 1988. And it has been a while since I have had boots on and cut fireline, but the members of AFE and FUSEE, are currently serving on the firelines, even now in southern California, and would like me to talk about some of our shared concerns about changes in fire behavior resulting from climate change.

Fire behavior is changing. In Yellowstone in 1988, the grizzled old firedogs told us that we would never see fire behavior like that again because they never had. Now, most summers bring us new record-breaking fires and fire seasons, and the fires we call big today can be 10 times as big as the ones 20 years ago.

On the firelines, it is really clear that global warming, global climate change, is changing fire behavior and creating more and bigger, severe fires; and we have had a fair bit of testimony to that extent.

But this isn't the only news here. Many firefighters we know have commented that they are facing more extreme fire behavior than they have ever witnessed, and among fire scientists there is a broad consensus that the fire frequency and size and severity will continue to occur.

So weather does drive a lot of these fire events. We are experiencing weather phenomena that are unprecedented in the historical record. And because of these changing patterns, as many people pointed out here, the wildfire season in the West is roughly 78 days longer than in 1987, a really profound change.

This is taxing on the endurance of the firefighting crews and draining budgets of land management agencies, as we have heard.

Because of this behavior, firefighters have been forced to change firefighting tactics. Perimeter control and its tactics of anchor, flank, and hold fires have been almost futile in megafires. Firefighters in the northern Rockies had to give up aggressively fighting fires because it was extremely unsafe and almost completely ineffective. Instead, they have adopted a strategy of indirect attack and point protection to make sure individual homes and communities are protected. And they are forced to light very large backfires that were also burning with high severity.

Meanwhile, communities are sprawling into high danger areas. With severe weather conditions, firefighters are often unable to keep fire from spreading into vulnerable communities. And this will be a factor all over the country, not just the West. Unfortunately, development patterns and the designs of homes rarely consider wildland fires at this point, and this is putting both homeowners and firefighters in harm's way.

Firefighters are rightly becoming unwilling to risk their lives to protect individual homes that are located in absurdly indefensible locations like at the top of narrow chimney canyons or built with highly combustible materials or completely surrounded by dense, flammable vegetation.

There are two kinds of fire requiring two very different sets of fire policies. Fire management policies need to distinguish between back country wildland, many of which are comprised of fire-adapted ecosystems, and front country communities with built environments, many of which are largely unprepared for fire.

Conflating wildland fire policies and urban policies will lead to inappropriate forest management and ineffective community protection policies. Stated simply, if our homes and communities were far more fire resistant, we would have it as a tool rather than an enemy in the back country. Ecological restoration programs could carefully reintroduce fire to prescribed burning and wildland burning use.

However, some of my colleagues speculate that we have perhaps a 10-year window to reintroduce fire at a landscape scale and still have effective control over fire behavior, but beyond that, we may lose this control due to climate changes and the temperature changes as pointed out here.

In rural communities, it is getting late now even to address some of these needs for land use zoning, revised building codes and enforceable vegetation management ordinances. Climate change is going to create more fire-prone environments.

We have to break the cycle of new homes being rebuilt in the same places with the same materials as the homes that were destroyed by the last fire. Ideally, our goal should be to create a fireproof set of structures that are able to dwell sustainably in a fire-permeable landscape.

We need to be proactive, not reactive, to manage wildland fires in a changing climate. Our traditional strategies that focused on prevention and suppression have become increasingly ineffective and unsustainable.

Large wildfires defy our ability to put them out. They often burn until the weather changes. The attempt to extinguish all fires has, in fact, caused huge costs to taxpayers, significant environmental damage, and put firefighters at unnecessary risk.

It is important to acknowledge that there are forces in nature that cannot be controlled and perhaps megafires should be viewed like hurricanes, earthquakes and volcanic eruptions, natural disturbances that we must adapt to since we can't prevent them. This is not fatalism, but instead a plea for realism and a change from reactive fire suppression to proactive fire management.

The CHAIRMAN. I thank the witness. The witness' time has expired. And you will have plenty of time in the question-and-answer period to expound upon your points.

[The statement of Mr. Medler follows:]

Testimony of Dr. Michael Medler
Member, Firefighters United for Safety, Ethics, and Ecology
President-Elect, The Association for Fire Ecology
Associate Professor, Department of Environmental Studies,
Huxley College, Western Washington University
before the Hearing on "Wildfires and the Climate Crisis"
Select Committee on Energy Independence and Global Warming
U.S. House of Representatives, Washington, D.C.
November 2, 2007

Chairman Markey, ranking member Sensenbrenner, and members of the Committee, I want to thank you for this opportunity to be here and testify on the matter of climate change and fire management. My name is Michael Medler, and I am an associate professor in the Environmental Studies Department at Western Washington University, the president-elect of The Association for Fire Ecology (AFE), and a member of Firefighters United for Safety, Ethics and Ecology (FUSEE).

I worked as a seasonal wildland firefighter for the U.S. Forest Service in the 1980s, and really cut my teeth as a sawyer while fighting the Yellowstone fires in 1988. Although it has been awhile since I put on my fire boots and cut fireline, several of our members in AFE and FUSEE are currently serving on the firelines in Southern California, and I wish to share with you their concerns about the changes in fire behavior resulting from global warming and climate change.

FIRE BEHAVIOR IS CHANGING

In Yellowstone in 1988 I remember being told over and over by veteran firefighters that we would never see fire behavior like that again in our lifetimes. Now, 20 years later, most summers bring us new record-breaking wildfire incidents and record-breaking fire seasons. In Idaho, for example, the year 2000 set a record for amount of acres burned, but this record was broken last year and then broken again this year with almost 2,000,000 acres burned by wildfires. "Megafires" are now routinely occurring in many parts of the U.S. on both public and private lands.

Last year the East Amarillo Complex in Texas burned 907,000 acres of mostly privately-owned rangelands, spreading 45 miles from its points of origin in the first nine hours after ignition. This year in Alaska the 260,000 acre Anuktuvuk River Fire was the largest wildfire in recorded history north of the Brooks Range, and burned over 112,000 acres on a single day in September—unprecedented fire behavior so late in the season. On this year's 300,000 acre Cascade Complex in Idaho, the fire spread so rapidly that it entrapped and burned over an entire firefighter camp, fortunately without killing anyone. These formerly "anomalous" wildfire events are occurring with greater frequency due to climate change.

I must point out that uncharacteristic fire severity should be more our concern than fire size because wildland fire has historically shaped many landscapes and is essential for

the survival of many plants and animals. Some ecosystems like southern California's chaparral country are experiencing a surplus of ignitions, but other ecosystems are experiencing a "fire deficit," and our continued attempts to indiscriminately exclude wildland fire poses significant risks, costs, and impacts to firefighters, taxpayers, and the environment. But on the firelines, it is clear that global warming is changing fire behavior, creating longer fire seasons, and causing more frequent, large-scale, high-severity wildfires. Many firefighters have commented that they are facing more extreme fire behavior than they have witnessed in their lifetimes. Among fire scientists there is broad consensus that these changes in fire size, fire frequency, and fire severity will continue to occur as the climate continues to change.

WEATHER DRIVES LARGE WILDFIRE EVENTS

Several of our members in AFE and FUSEE serve as fire behavior analysts, but the computer models they use to predict the rate of fire spread and fireline intensity often fail to accurately predict the actual observed fire behavior faced by firefighters. This is because the models rely on historic weather data, and we are experiencing weather phenomena that is unprecedented in the historic record. Record-breaking readings of the Burning Index and Energy Release Components are weather-driven, and have all been associated with recent megafires.

Although lots of attention has been given to reducing hazardous fuel loads, the problem of large-scale high-severity wildfires is more complex than dealing with fuel loads alone. In particular, weather is a major driver of large wildfire events. Prolonged droughts, high temperatures, low relative humidities, and strong winds create tinder-dry vegetation that ignites easily and spreads fire rapidly across any kind of fuel type—it can launch flames across eight-lane freeways and loft burning embers up to a couple miles in front of a wildfire to light new fires. The precautionary principle should be applied before embarking on landscape-scale fuels reduction treatments that reduce overstory canopy structure but neglect understory surface fuel loads, and cause microclimatic conditions that exacerbate the effects of a warmer, drier climate.

Climate change is also affecting precipitation patterns so that in many places more precipitation is falling as rain instead of snow, and the snow that does accumulate melts earlier in the spring and returns later in the fall. Since 1987 the average wildfire season in the West has now lengthened an extra 78 days, and periods of high or extreme fire danger are occurring earlier in the summer. Viewed on a national scale, we are witnessing the end of the seasonality of wildfire as it becomes a year-round phenomenon that rotates around the various ecoregions. This is taxing the endurance of firefighting crews and draining the budgets of land management agencies.

FIREFIGHTING STRATEGIES AND TACTICS ARE CHANGING

Along with the increased occurrence of extreme fire behavior, firefighters have been forced to change strategy and tactics. The traditional firefighting strategy of "perimeter control" and its tactics of "anchor, flank, and hold" proved to be largely futile in the

megafires of 2006 and 2007. Firefighters in the Northern Rockies, especially Idaho, had to basically give up on aggressively fighting fires in the forest because it was extremely unsafe and almost completely ineffective. Instead, they adopted the strategy of "indirect attack" and "point protection" to make sure individual homes and communities were protected from wildfire ignition, while essentially letting the fires burn across the landscape. In many cases, firefighters were forced to light large-scale backfires that burned with high severity because they were ignited during severe fire weather conditions.

COMMUNITIES ARE SPRAWLING INTO HIGH WILDFIRE DANGER AREAS

Sprawling suburban/exurban developments built in fire-prone areas are also affecting firefighting strategies and tactics because actions are more focused on protecting structures than on suppressing wildland fire. When severe weather conditions fuel extreme fire behavior, however, firefighters are often unable to stop fire from spreading into vulnerable communities. All the air tankers in the world cannot help defend communities if fierce winds or dense smoke make them unable to fly safely.

Development patterns including the location of communities, and the design and construction materials of homes, rarely consider wildland fire dynamics, and this is putting both homeowners and firefighters in harm's way. Firefighters are rightly becoming more unwilling to risk their lives to protect individual homes from wildfire when they are located in absurdly indefensible locations like the top of narrow "chimney" canyons, or are built with highly combustible materials like wooden "shake" roofs, or are completely surrounded by dense flammable vegetation.

TWO KINDS OF FIRE REQUIRE TWO SETS OF FIRE POLICIES

Nowadays it seems that nearly every wildland fire threatens rural homes and communities. Yet, once a wildland fire enters a subdivision or cluster of homes, it becomes less of a wildland fire and transforms into an urban fire. Fire management policies thus need to distinguish between backcountry wildlands, many of which are comprised of fire-adapted ecosystems, and frontcountry communities or the built environment, many of which are largely unprepared for wildfire. Conflating wildland fire with urban fire has led to inappropriate forest management and ineffective community protection policies.

In wildlands that have been degraded by past land management practices including fire exclusion, ecological restoration programs should carefully reintroduce fire through prescribed burning and wildland fire use. Some of my colleagues speculate that we have perhaps a ten-year window of opportunity to reintroduce fire on a landscape-scale and have some control over fire behavior with desirable effects, but beyond that time frame we may lose this control due to climate change. The whole ecological restoration agenda is challenged, however, by the uncertainty of facing future climatic conditions that may be unlike anything experienced in the past.

In rural communities, it is past time that we address the needs for some land use zoning, revised building codes, and enforceable vegetation management ordinances on private property in order to reduce home ignitability. Climate change is going to create more wildfire-prone environments, and the cycle of new homes being rebuilt in the same places with the same materials as the homes that were destroyed by past wildfires must be broken. It is clear from experience that lightning or arsonists can strike in the same places more than once! Ideally, our goal should be to create fireproof structures able to dwell sustainably in fire-permeable landscapes.

NEED TO BE PROACTIVE, NOT REACTIVE, TO MANAGE WILDLAND FIRES IN A CHANGING CLIMATE

Our traditional strategies that focused on fire prevention and fire suppression have become increasingly ineffective and are not sustainable. Given natural lightning ignitions and those of criminal arsonists or careless recreationists, wildfires will inevitably occur. The attempt to exclude fire from the landscape has, in fact, caused great harm to those ecosystems that evolved with, adapted to, or depend upon recurring fires. It is important to understand that there are a variety of fire regimes, including some that naturally burn with high severity, that have not been significantly affected by climate change—yet.

Given the increasing frequency and duration of severe fire weather conditions, large wildfires defy human ability to "put them out" and they will inevitably burn until the weather changes. The attempt to extinguish all fires has, in fact, caused huge costs to taxpayers, significant environmental damage, and put firefighter safety at unnecessary risk. It is important to acknowledge that there are forces of Nature that cannot be humanly controlled, and perhaps megafires should be viewed as similar to hurricanes, floods, earthquakes, and volcanic eruptions—natural disturbances that humans must adapt to since we cannot prevent or stop them. This is not a pitch for fatalism, but instead, a plea for realism and a change in paradigm from reactive wildfire suppression to proactive fire management.

Historically, legislation and policy changes in wildland fire management have always followed large wildfire disasters, reacting to those events after the damage has been done. For the future's sake, we need to take *proactive* steps to mitigate the effects of uncharacteristically severe wildfires, and adapt to altered fire regimes caused by climate change and variability due to global warming.

In 2006 at the Third International Fire Ecology and Management Congress--an event attended by over 1,200 fire scientists and managers from 26 different countries across six continents--the "San Diego Declaration on Climate Change and Fire Management" was formally ratified. This historic document presents a synopsis of the best available science on the effects of climate change on fire regimes and wildland fire, and provides a list of action items for proactive fire, fuels, and ecosystem management, and fire research, education, and outreach.

The San Diego Declaration offers a "wish list" for policy reform and legislation that we recommend this Committee and Congress as a whole examine closely. Among the Declaration's many recommendations for action are the following:

- Incorporate the likelihood of more severe fire weather, lengthened wildfire seasons, and larger-sized fire when planning and allocating budgets, which traditionally are based on historical fire occurrence.

- Develop site-specific scenarios for potential weather event linked to climate change and redesign fire management strategies for rapid response to these events.
- Consider climate change and variability when developing long-range wildland fire and land management plans and strategies across all ownerships.
- Evaluate probable alternate climate scenarios when planning post-fire vegetation management, particularly when reseeding and planting.
- Prepare for extreme fire events by restoring some ecosystems and reducing uncharacteristic fuel levels through prescribed burning, mechanical treatments, and wildland fire use to meet resource objectives.
- Expand wildland fire use at the landscape scale in fire-adapted ecosystems to restore fire regimes and reduce fuel loads.
- Implement long-term monitoring programs in fire-adapted ecosystems that are expected to undergo the widest range of variability linked to climate change.
- Expand interdisciplinary research to forecast potential fire season severity and improve seasonal weather forecasts under future climate change scenarios.
- Integrate the subject of climate change and its influences on ecosystem disturbances into curricula within natural resource programs at secondary school, university, and continuing education levels.
- Disseminate information to the general public and government agencies regarding the potential impacts of changing climate on local natural resources, particularly those that interact with fire.
- Form interdisciplinary teams of researchers that include fire ecologists and climate scientists to identify and pursue emerging areas of climate and fire research.

We would like to enter the full San Diego Declaration into the record along with our testimony, and urge Congress to do whatever you can to facilitate implementation of its many recommendations.

GLOBAL WARMING IS A FIRE ISSUE

Alongside melting glaciers, rising sea levels, and stronger hurricanes, it is clear that conflagration wildfires or "megafires" are providing another dramatic signal of climate change. In our view, global warming is fundamentally a *fire* issue, for it is the *burning* of fossil fuels that is the primary anthropogenic cause of climate change.

Consequently, we must bridge the gap between the Nation's energy and climate policies, and our wildland fire management policies. The best available science and the professional experience of wildland firefighters justifies taking action now to reduce fossil fuel burning while at the same time addressing land management practices, rural development patterns, and fire management policies in order to confront both the causes and consequences of the climate crisis.

Wildland firefighters serve on the frontlines of climate change, and have high hopes that Congress will craft sound energy, land management, and urban development policies that effectively deal with the "burning issue of our time." Thank you very much.

The CHAIRMAN. Our next witness, Michael Francis, is the Deputy Vice President for Public Policy and the Director of the National Forest Program at The Wilderness Society. He is a nationally recognized expert on these issues.

We recognize you, Mr. Francis. Whenever you are ready, please begin.

STATEMENT OF MICHAEL FRANCIS, DIRECTOR OF FOREST PROGRAMS AND DEPUTY VICE PRESIDENT, THE WILDERNESS SOCIETY, ACCOMPANIED BY TOM DeLUCA, SENIOR SCIENTIST

Mr. FRANCIS. Thank you, Mr. Chairman, members of the committee. I am accompanied today by Mr. Tom DeLuca, who is sitting behind me here, who is going to be available to answer questions that go well beyond my pay grade.

First, our thoughts are with all of those whose lives, homes, and livelihoods were threatened by the recent fires. We also salute the firefighters, risking their lives, as well as the many community volunteers that helped the affected communities. Their efforts, bravery and determination to demonstrate that American sense of community is alive and well.

Mr. Chairman and members of the committee, there are five key points that The Wilderness Society would like to leave you with today.

Number one, wildfire is a regular and healthy occurrence in a forest ecosystem. Our forests have evolved over the last 10,000 years on the North American continent, and fire has been a critical ecological process. We have learned that we cannot stop the fires and we cannot exclude them from the forest. And slowly, I think, the country is beginning to understand that we must be fire tolerant in fire-dependent ecosystems.

Second, our climate is changing, as we had a distinguished panel member here state about the impact of temperature increase and water regimes. One of the points I pick out from the IPC report is its projection that precipitation will decrease in the southern U.S.—southwestern U.S.—and will cause drought through much of the 21st century. Historically, increases in fire—fire increases correspond to warmer, drier periods.

Three, climate change makes forests more susceptible to changes in wildland fire behavior and in the seasons. Warmer winters contribute to summer drought. Reductions in snowpack depth and duration alter timing and volumes of water runoff, leading to longer summer droughts, larger water deficits and more severe fire seasons.

The changing climate in fire behavior calls for changing U.S. Forest Service management policy direction to one of ecological restoration, stewardship to restore and maintain forest resiliency in the face of global warming.

Four, wildland fire in the long term is at least carbon neutral and potentially positive—or negative. I am sorry, negative.

Harvesting trees will not stop fires; such harvests avert the causes or impacts of climate change. There is cycled carbon and noncycled carbon. Forest carbon represents the type that constantly cycles through the environment such as the carbon that humans

exhale and wildfires release. Fossil fuels represent the type that nature permanently stores in the Earth.

All carbon released in a fire has been cycling back and forth between the forest and the atmosphere for a millennium. Fire changes the location and the state of the carbon in the system, but it does not change the amount.

About 5 to 10 percent of biomass killed by wildland fire is converted into charcoal, a uniquely stable form of carbon which will remain stored for thousands of years. Also, forest regeneration after fires recaptures carbon lost during the fires; in other words, over the long run, fire may help forests store carbon, not release it.

Five, targeting fuels reduction around communities can reduce the threat of wildland fire to people, their homes, and their communities. The wildland fire triangle says that three factors could affect fire behavior—topography, weather, and fuels.

Though weather will increasingly play the trump card in influencing fire behavior, managing fuels will continue to be important. Research shows that hazardous fuels reduction treatments in appropriate types of fire regimes and locations are often effective in decreasing the severity of subsequent fires. However, it is not feasible nor recommended that all forests be thinned.

Faced with decades of long fire seasons and the near certainty of large blazes across the landscape, it is more important now than ever before to apply the tools of hazardous fuels reduction surgically and scientifically. Without exception, the first priority of hazardous fuel reduction and fire management should be keeping families safe and protecting communities.

Thank you.

[The statement of Mr. Francis follows:]

Testimony of
Michael A. Francis
Director, National Forests Program, &
Thomas H. DeLuca, Ph.D.
Forest Ecologist
The Wilderness Society

Before the House Select Committee on
Energy Independence and Global Warming
On
Wildland Fire and the Climate Crisis

Mr. Chairman, I want to open my testimony before the Select Committee reading a quote from Mr. Tom Boatner, who, after 30 years of fighting wildland fires, is now the chief of fire operations for the US Forest Service. In CBS News 60 Minutes piece just a few weeks ago on this year's fires in the West, Mr. Scott Pelley said to Mr. Boatner: "You know, there are a lot of people who don't believe in climate change." Mr. Boatner replied: "You won't find them on the fire line in the American West anymore, because we've had climate change beat into us over the last 10 or 15 years. We know what we're seeing, and we're dealing with a period of climate, in terms of temperature and humidity and drought, that's different than anything people have seen in our lifetimes."

As we debate how best to address the challenges of managing wildland fires in an era of global warming, The Wilderness Society believes that, without exception, the first priority of fire management should be keeping families safe and protecting communities. While Southern California faces exceptional fire danger due to its unique vegetation, climate, and residential development, there are thousands of communities across the West and the nation that are at increased risk of fire as a consequence of climate change. The Wilderness Society strongly urges Congress to provide greater assistance to these communities so they can take the common-sense actions necessary to reduce their vulnerability to wildfires.

Mr. Chairman, there are 5 key points that The Wilderness Society testimony will cover:

1. Wildland fire is a regular and healthy occurrence in forest ecosystems, especially in dry forests of the West.
2. Our climate is changing.
3. Climate change makes forests more susceptible to changes in wildland fire behavior and seasons.
4. Wildland fire in the long term is at least carbon neutral and potentially negative.
5. Targeted fuel reduction around communities can reduce the threat of wildland fire to people, their homes, and communities.

1. Wildland Fire is a regular and healthy occurrence in forest ecosystems, especially in dry forests of the West

For eons fire has played an essential role in maintaining the health and resiliency of many ecosystems. For as long as there have been forests, there have been wildland fires. Wildland fire is as natural and necessary as sunshine or rain to a healthy forest. Nature uses fire to transform dead and dying material into nutrients, to control insect populations, and to provide living conditions for wildlife. Burned trees provide critical habitat for many animals, and the slow decay of burned trees provides nutrients essential to rejuvenating growth. In fact, logging after a fire and replanting trees is not necessary to restore a forest impacted by fire; this practice can actually increase the risk of future fire and cause irreparable damage to the landscape.

Fire plays a critical role in the functioning of ecosystems. A allowing fire to begin resuming its natural role in forests will go a long way towards reducing the long-term risk of severe, catastrophic fires, and thus in turn, will reduce costs. With the wildland-urban interface growing each year, there will never be enough resources to suppress all fires. Therefore, money is best used suppressing those fires that threaten communities while allowing those fires away from communities to play their natural role in maintaining healthy ecosystems.

Unfortunately, years of drought, increased development near wildland areas, a century of suppressing all fires, and past forestry practices have made fire management much more complicated for policymakers, legislators, and firefighters today. For the last century, fire management policy has been largely grounded in the belief that all fires should be extinguished. With well-trained, well-funded professional firefighters and new technology, we suppress nearly 85 percent of all wildland fires almost immediately. While these fire suppression efforts have been resoundingly successful, they continue to have significant, unintended, and decidedly negative consequences. Interrupting natural fire patterns has thrown ecosystems and fire cycles out of balance, and in many places, actually increases the risk of unnaturally severe fire through the buildup of highly flammable fuels. As a result, uncharacteristically severe fires threaten communities and important natural resources, and contribute to skyrocketing suppression expenditures. Suppression costs the federal government over $1 billion in four of the last seven years.

2. Our climate is changing

Climate change does impact forest fire activity. Research has shown that climate change has likely increased the length of the fire season and thereby the number and size (but not necessarily the severity) of fires that burn any given year. At the same time, we know that forest fire activity also impacts climate change.

Research confirms that fire regimes are changing and will continue to change across North America. Some of this change is due to the changing climate. These changes may complicate fire management and suppression, alter ecosystems, and increase the risk of fire. This year, the Intergovernmental Panel on Climate Change (IPCC) projects increased frequency and intensity of drought[1];

[1] Intergovernmental Panel on Climate Change. 2007. *Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the IPCC. Report #: 978 0521.

additionally, temperatures are projected to increase 1 to 4 degrees over the next century, resulting in less snow and increased heat absorption from exposed ground.[2]

In addition, these swings in temperature and moisture averages can affect the distribution of vegetation on the landscape. These changes will certainly alter ecosystems, increase the frequency of fire, and in so doing, complicate fire management and suppression.

3. Climate change makes forests more susceptible to changes in wildland fire patterns

Studies show that weather patterns and climate variations have contributed to the increase in large and severe fires in some areas of the country. The 2007 IPCC report shows clear patterns of temperature increases and long-term trends in precipitation change since 1900. These changes are greatest at northern latitudes in boreal and arctic zones.

The IPCC projects that precipitation will decrease in the southwestern US and it will cause severe drought for much of the 21st century. Historically, increases in fires correspond with warmer, dryer periods.

Additionally, the longer the intervals occur between fires, the more severe and intense the fires. Thus, suppression of frequent, low severity fires in forests, where this type of fire regime is predominate, leads to unusually high fuel accumulations and increasingly large and severe wildland fires.

Extent and severity of drought, timing of spring snowmelt, and changes in ocean circulation patterns influence the extent and severity of wildland fire. Warmer winters contribute to summer drought; reductions in snow pack depth and duration alter the timing and volume of runoff, leading to longer summer droughts, larger water deficits, and more severe fire seasons.

Most forested ecosystems in the United States are uniquely adapted to, and dependent upon, natural wildland fire. Changing US Forest Service management direction to one of ecological restoration and stewardship is critical to restoring and maintaining forest resiliency in the face of global warming. One important way forests will be able to resist the effects of climate change is through the restoration of key functions and processes, like fire.

The practice of managing forests for their resource benefit is known as Wildland Fire Use, which is the management of naturally ignited fires to achieve resource benefits. Where wildland fire is a major component of the ecosystem, WFU is one of the best ways to restore forest resiliency to climate change, while also reducing suppression costs and hazardous fuels. Other restoration tools, like obliterating roads, protecting roadless landscapes, protecting old-growth forests, reducing fragmentation, etc., are also critical in helping forests resist the effects of climate change.

[2] Dr. Helms PhD, J. Written testimony from the Senate Energy and Natural Resource Committee: Scientific assessments of impacts of global climate change on wildfire. Washington, DC, September 24, 2007, P-1.

4. Wildland fire in the long term is at least carbon neutral and potentially negative

While fire does release carbon to the atmosphere, this addition cannot be compared with that of burning fossil fuels. Forest fires release carbon dioxide and carbon monoxide, both of which are greenhouse gases. However, all of the carbon released in a fire is carbon that has been cycling back and forth between forests and the atmosphere for millennia. Fire or decay releases carbon to the atmosphere, and regrowth ties it back down. Fire changes the location and the state of carbon in the system, but it does not change the amount. Burning of forest biomass represents a release of carbon that was fixed by photosynthesis in the recent past. Burning fossil fuels, by comparison, takes carbon out of geological deposits and adds this paleo, non-cycling carbon to the atmosphere, thereby causing a net increase in total ecosystem carbon. Furthermore, soot and aerosol emissions from the burning of biomass have been found to have a far lower climatic effect compared to soot associated with fossil fuel emissions.[3] In spite of the acreage burned in 2007, carbon emissions associated with forest fires this year accounted for only about 3 – 10% annual fossil fuel carbon emissions in the US.

When a forest fire burns, typically only about 20 percent of the biomass is consumed by fire and converted to gaseous carbon. The majority of biomass remains on site as dead trees, live trees, and as charcoal. Live trees will continue to store carbon, and dead trees will decay and slowly release carbon dioxide for decades. Regrowth after wildland fires begins to store carbon from the atmosphere, reversing the emissions caused by fire.

Importantly, about five to ten percent of the biomass killed by wildland fire is converted to charcoal, a uniquely stable form of carbon which, if mixed into mineral soil or washed into water bodies, will remain there for thousands of years.[4] Over millennia, charcoal formation can make a forest exposed to fire 'carbon negative.' In other words, over the long run, fire may help forests *store* carbon, not release it.

Harvesting timber does not engender *permanent* carbon storage. Nearly half of the carbon in a harvested tree is left in the woods,[5] much of which is burned as slash (releasing carbon to the atmosphere), and another quarter of the tree's carbon is lost as mill residue (often burned as hog fuel and again released to the atmosphere). In the end, only about fifteen percent of the harvested tree's carbon winds up stored in 'durable woody products.' Even then, softwood lumber has a half-life of less than 40 years; this is truly only temporary carbon storage.[6]

5. Fuel reduction reduces the threat of fire to communities

The Wildland Fire Triangle says that three factors affect fire behavior- topography, weather, and fuels. Though weather will increasingly play the trump card in influencing fire behavior, managing

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[3] Hansen, J., M. Sato, P. Kharecha, G. Russell, D. W. Lea, and M. Siddall. 2007. Climate change and trace gasses. Philosophical Transactions of the Royal Society A. 365:1925-1954.

[4] DeLuca, T. H., and G. H. Aplet. 2007. Charcoal and carbon storage in forest soils of the Rocky Mountain West. Frontiers in Ecology and the Environvironment 6:1-7.

[5] Ingerson, A. 2007. U.S. Forest carbon and climate change. The Wilderness Society, Washington, DC.

[6] Smith, J. E., L. S. Heath, K. E. Skog, and R. A. Birdsey. 2005. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Northeast General Technical Report 34, United States Forest Service, Washington, DC.

fuels will continue to be important. Research shows that hazardous fuel reduction treatments in the appropriate type of fire regime and location are often effective at decreasing the severity of subsequent fires. However, it is not feasible, nor recommended, that all forests across the wildland fire regime spectrum be thinned.

Successful wildland fire management will incorporate principles of prioritization based on reliable information; distinguish between fuel treatment for community protection and for ecological restoration; fight fires only where they have to be fought for community protections or other resource values; use mechanical thinning and/or prescribed fire to manage fuels where it is not safe to use wildland fire, or in advance of Wildland Fire Use; invest in better information and tools for wildland fire management; facilitate local collaboration; and monitor conditions over time.[7]

Faced with decades of longer fire seasons and the near certainty of large blazes across the landscape, it is more important now than ever before to apply the tool of hazardous fuel reduction surgically, not by a shotgun approach. Without exception, the first priority of fire management should be keeping families safe and protecting communities. The Wilderness Society's research has shown that up to 85% of the land around communities at highest risk for wildland fires is state or private. However, the bulk of federal funds for wildland fire preparation are spent on federal lands. While fire management is often perceived as a federal issue, fires do not respect jurisdictional lines on a map. To make saving homes and lives truly the top priority, we must target scarce resources around communities.

Policies are needed that get federal money to local communities, where it can be spent on planning and implementing locally based, collaborative community protection strategies that target those acres that provide the greatest benefit. In 2001, the US Forest Service and the Department of the Interior identified over 11,000 communities adjacent to federal lands that are at risk from wildland fire.[8] State foresters conservatively estimate 45,000 communities at risk.[9] The scope of the problem is clearly enormous - and growing. Experts predict that almost eight million new homes will be built in the Wildland Urban Interface (WUI) in the second half of the current decade.[10] Increased population in the WUI has contributed to skyrocketing suppression costs that have totaled over $1 billion in four of the last seven years.[11] Communities that are "FireWise," or well-prepared for the inevitable wildland fire, are key to reducing these suppression costs – and ultimately restoring functional and fire-resilient wildlands. State Fire Assistance (SFA) is the primary federal program that can help communities achieve these goals. It provides cost-sharing funds to help states and communities prepare for and respond to wildland fires, including purchasing equipment and providing firefighter training. The funding is also used to support Community Wildfire Protection Planning (CWPP) and hazardous fuels reduction (reducing dense vegetation build-up) near communities.[12]

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[7] The Wildland Fire Challenge; Focus on Reliable Data, Community Protection, and Ecological Restoration, October 2003, Aplet and Wilmer

[8] 66 FR 43384-43435

[9] Southern Group of State Foresters, Southern Wildfire Risk Assessment Final Report (2006), p. 75, http://dev.sanborn.com/swra/content/reports/finalrpt.htm.

[10] U.S. Forest Service and Department of the Interior Quadrennial Fire and Fuel Report (2005)

[11] U.S. Forest Service, FY2008 Budget Justification, p. 3.

[12] U.S. Forest Service FY2008 Budget Justification, p. 8-14 to 8-15 and 11-39 to 11-40; Forest Service FY2007 Budget Justification, p. 9-42.

In recent years SFA has been the subject of recurring proposed cuts. The Administration proposed a 30% reduction for FY 2007 and a 14% reduction for FY 2008.[13] Those cuts are compounded by the fact that federal funding dedicated to those programs that foster non-federal partnerships in forest and fire management amounted to less than 10% of the $14 billion appropriated to the National Fire Plan in the last five years.[14] State foresters estimate that funding for State Fire Assistance needs to increase by nearly 85% - to $145 million - in order to meet current and emerging needs.[15]

In addition, because suppression appropriations have fallen short of needs, even with emergency appropriations, agencies have had to borrow money from other programs to fund their suppression activities. These funds are often borrowed from the very programs – hazardous fuels reduction and community assistance – that represent the best hope of decreasing the damage and bringing down the costs associated with wildland fire. Clearly, this pattern is not only inefficient, but it fails to address wildland fire in a sustainable, long-term way.

Individual homeowners and businesses can take action as well by participating in FireWise, which includes actions that improve a home's fire resistance and modifies the home's surrounding landscape to reduce the spread and intensity of fires. However, the greatest reduction in risk will occur in communities that take a comprehensive approach, through a Community Wildfire Protection Plan, managing forests with controlled burns and thinning, promoting or enforcing appropriate roofing materials, and maintaining defensible space around each building.

In these fire stressed times of climate change, continual assessment of effectiveness in fuel treatments and in community protection is essential in adaptive management. Reviews of effects from advanced prescribed fire, mechanical fuel reductions or thinning, fuel breaks around communities, and direct FireWise actions around structures, when fires do occur, is necessary to refine and to modify these tools.

Improving the resiliency of forest ecosystems would best be accomplished by returning forests to a natural state. A central tenet of forest restoration is the recreation or rehabilitation of natural composition and processes within ecosystems with the explicit understanding that the natural condition is a sustaining entity. Sustainable forest management is an elusive and challenging concept that requires consideration of how the current forest condition was achieved, an understanding of the historical structure and function in indigenous forest ecosystems, consideration of the influence of shifting drivers (e.g. climate and human pressure) of future forest condition, and a realization that on the ground activities may require modification and corrections over time to achieve long-term objectives. Sustained forest productivity and diversity in managed forest ecosystems is greatly dependent upon the synergy between management strategies and landscape level processes. Thus,

[13] U.S. Forest Service FY2007 Budget Justification, p. 4-11 shows total National Fire Plan funding for FY06 and that proposed for FY07. There is a 30% reduction proposed in total SFA funding. U.S. Forest Service FY2008 Budget Justification, p. 8-1 and 11-1 shows SFA funding for each account. Total FY07 funding compared to proposed FY08 funding shows a proposed 14% reduction.

[14] Specifically those line items under The National Fire Plan associated with state and local assistance including Forest Health Management (Coop Lands), State Fire Assistance and Volunteer Fire Assistance under Wildland Fire Management and Forest Health Management (Coop Lands), State Fire Assistance and Volunteer Fire Assistance under State and Private Forestry, as well as other State and Private Forestry programs that assist communities, including the Economic Action Program, Forest Stewardship, Urban & Community Forestry and Forest Research & Information Analysis (except Forest Legacy because lands acquired under this program are not specifically tied to fire planning or management.). Data source: USFS Budget Justifications 2005, 2006, 2007 and Budget Justification Overview for FY 2008.

[15] Council of Western State Foresters Statement for the Record, U.S. House Committee on Appropriations, Subcommittee on Interior, Environment, and Related Agencies, Fiscal Year 2008 Appropriations Recommendation State Fire Assistance Program (April 19, 2007), http://www.wflccenter.org/news_pdf/231_pdf.pdf.

restoration forestry must attempt to recreate natural processes through manipulation of forest structure, composition and function and that these modifications are conducted in a manner that maximizes connectivity between restored and natural landscapes.

Attachment: Charcoal and carbon storage in forest soils of the Rocky Mountain West
Thomas H DeLuca, Ph.D. and Gregory H Aplet, Ph.D. 2007

The CHAIRMAN. Thank you, Mr. Francis, very much.

The Chair will now recognize himself for a round of questions.

I asked Chief Kimbell on the first panel if she considered global warming's impact on wildfires a threat to the public welfare. I would like to ask each of you if you could briefly tell me if you believe that it is.

Dr. Running.

Mr. RUNNING. I think there is no question that as we look at the climate trends that we are documenting, we look at the projected trends that the GCMs predict for the future, and we see the current acceleration of wildfire and the acceleration of people building homes in fire-prone areas, it all just adds up to this issue getting bigger and bigger.

The CHAIRMAN. Dr. Medler, please.

Mr. MEDLER. I would like to concur with Dr. Running. There is a whole set of complicated issues that come together, but clearly most of the models and many of our predictions indicate we are going to be seeing increased fire behavior, fire severity.

The CHAIRMAN. Because of global warming?

Mr. MEDLER. I am willing to say that.

The CHAIRMAN. Mr. Francis.

Mr. FRANCIS. I would say ditto to what my colleagues have said. It is one aspect that we are going to see as a result of global warming, so it is a threat as global warming is a threat.

The CHAIRMAN. Now, again, we had an online question that came in, and that was from a gentleman in Missouri who e-mailed us a question.

It was: As experts in fire science or forest policy, do you worry about the expansion of wildfires across the country to areas that have not typically experienced them and may be unprepared to deal with them?

And relate it to global warming, please.

Dr. Running.

Mr. RUNNING. Yes. I think we are already seeing areas that have not had historical fire, that with forests under more stress, this is an expectation that you would get from ecosystem theory.

The CHAIRMAN. Dr. Medler.

Mr. MEDLER. Well, yeah.

To continue, there is plenty of evidence that we are seeing these changes in fire behavior. There are also land management issues that have left large fuel buildups in some areas, not such a significant problem in others. And climate change, in particular, will make a lot of these areas vulnerable to fire beyond our historical expectations, and in many areas where we may not be used to seeing it quite as often as before.

I worked previously in New Jersey and we were getting surprised by large fires.

The CHAIRMAN. And you relate that to global warming?

Mr. MEDLER. That was 5, 6 years ago. I am hesitant to do that.

The CHAIRMAN. Mr. Francis.

Mr. FRANCIS. I would like to refer that answer to Tom DeLuca.

Mr. DELUCA. My name is Tom DeLuca. I am a senior scientist with The Wilderness Society.

The CHAIRMAN. Okay.

Mr. DELUCA. As Dr. Steve Running had pointed out, temperatures are increasing with climate change, and we have associated with that temperature change the same ecosystems that had existed in these locations under lower temperatures.

So the long and short of it is, yes, we are going to see higher biomass—we have higher biomass; that what exists in that temperature and that environment and those ecosystems will experience fires that would not be characteristic.

The CHAIRMAN. Now, Mr. Francis, some people have alleged that environmental groups are somehow responsible for the increase in wildfire because they have blocked projects to remove brush or to do controlled burns in order to protect the rest of the forests. But in 2003, the GAO found that 97 percent of these types of projects go forward without any opposition at all.

How would you respond to the allegations that litigation by environmental groups is actually responsible for the wildfires?

Mr. FRANCIS. I would respond by saying, look at the GAO report. The fact is, 97 percent of these projects make it through in the time that is set out by the law. A few do get litigated because they are bad projects. They are not projects that are supportable by science or the public. I mean, the Chief talked about the public dialogue and the public being involved in looking at what happens around their communities, and therefore, you need to involve that public.

And the Forest Service has a good record of having an appeal record that allows the public to participate when they strongly disagree. That is part of the process. It doesn't really delay anything on their project.

The CHAIRMAN. Dr. Running, could you respond to that, briefly?

Mr. RUNNING. I really have nothing more to add than what I see around Montana. And that is that there are—occasionally have been appeals that take a number of years to work through for things like salvage logging after fires and the value of the timbers then lost while the appeal process goes through.

But those, I don't have specific knowledge of the details on those.

The CHAIRMAN. Thank you, Dr. Running.

The Chair recognizes the gentleman from Washington state, Mr. Inslee.

Mr. INSLEE. Thank you all, and I want to welcome Dr. Medler from Western Washington. If you ever see a kid named Joe on campus, tell him to do his homework.

And you have some great students up there who have been working on clean energy issues. I am going to be talking to them about this book, Apollo's Fire, about a clean energy future for the country; and I note that because my sort of sense of your professional work—and I really appreciate your professional work, all three of you, in this regard.

But I really do believe as long as global warming continues to ravage these forests, there is really nothing that is going to significantly change the devastation occurring as long as we have these huge changes in the climactic system. And if that is true, it is incumbent upon us to develop a clean energy system that will indeed stop global warming to save these forests.

And when I say "save" them, I gotta tell you, it is just astounding to me. You know, we talk about this academically, but when

you are up there in the mountains and you see mile after mile after mile of dead trees, it is stunning. And I have been hiking those places for 56 years.

So I guess I will ask for your comments on that position. Is that really the fundamental thing we have to do to save these forests, which is to stop this human-caused climactic change? And I would ask for any of your comments.

Mr. MEDLER. I would chime in, agreeing with Mr. Francis here, that we have a complicated situation in that fire and ecosystem processes are just a part of this. As you are pointing out, in a global climate change situation, if we don't deal with the climate change itself, we are going to be stuck with immensely problematic forest issues. We have estimates as high as 190 million acres that are in need of some sort of treatment, and this includes the kinds of forests you are talking about.

And I am also very familiar with literally hundreds of acres, hundreds of thousands of acres at times, of what look like dead trees. Those are massive numbers. One hundred ninety acres is not the kind of area that you can thin by hand and clear out. Fire is the process we are going to need to reintroduce to do a lot of that treatment, but that is extraordinarily complicated because of policies that put housing digitized in there that is completely unprotectable.

So one of the critical elements is to let us use fire as a tool where it can help, and to do that, we need to protect communities.

As for your question about global climate change itself, I would concur that we need to deal with the imbalances that Mr. Francis was talking about. The globe as a system has got a certain amount of carbon in the biosphere and the atmosphere for quite some time, and that is what we are changing now by reintroducing carbon that can be tens, hundreds of millions years old, changing the total balance of the system and changing temperatures that allow insects to have two reproductive cycles or maybe, more importantly, survive through the winter.

In Canada, directly north of where I live, there are massive areas of insect damage, fire waiting to happen. There are literally millions of acres of dead trees, as you were pointing out; it is staggering when you drive through these large areas. And they can be directly attributed to what seemed like subtle temperature changes, just enough to allow insects to survive the winter.

Mr. INSLEE. I heard—or maybe I read it—that fire season has increased 78 days. Is that correct? What percentage of increase is that? I don't know how many days a fire season is.

Mr. RUNNING. Well, a fire season is obviously different in different climates, but that is on the order of a 20 to 30 percent increase in the number of days; and we expect another 20 or 30 percent increase with the climate model projections for the future.

So we are in the middle of the trend that has been progressing for 30 to 40 years, and there is no reason to believe it is going to slow down with any of the climate model projections we see.

Mr. INSLEE. Well, I think that suggests that we need to get going in Washington, D.C., to do something about climate change. And I have to tell you, we are on the cusp of doing that. We are making

some progress here. We need a President who won't stand in the way of progress to save these forests.

And I appreciate that you are trying to spread the word about this, because not only is a forest going to burn, but we are going to have people on that interface in danger, too.

So thank you for your professional work.

Thank you.

The CHAIRMAN. The gentleman's time has expired.

The Chair recognizes the gentleman from Mississippi, Mr. Cleaver.

Mr. CLEAVER. Thank you, Mr. Chairman.

I would like for the three of you—to get the comments from the three of you on this issue.

I have always been fascinated by—hopefully, it wasn't cynicism, but I have always been fascinated by people who build their homes on cliffs and then seem stunned when they fall during a mudslide. I mean, maybe it is because I can't afford to build one. But it is amazing to me.

And I am now becoming a little concerned about people who build their homes in areas that are prone to wildfires, previously, now the megafires.

And the concern is more than for the home. If the wildfires represent about 10 percent of the greenhouse gases, as is being suggested by the science, that is one level of a problem that has an adverse effect on human beings. But the one that is troubling me more is the prospect of airborne particles that result from a wildfire that the PM–10, the 10 micrometers and smaller particles that come up, that apparently a mask cannot filter. They are so small that they penetrate the masks that are being used in the area to protect human beings.

Do you think we are going to approach a time when we might need to discourage people from living in areas that could be ignited quickly where a mega wildfire could start?

We have got the greenhouse emissions and now the micro particles that—I am not sure what kind of medical damage that is doing. It can't—it is not going to be helpful.

So do any of you have—

Mr. RUNNING. Well, let me first address the immediate public health issue you bring up.

In Missoula, Montana, this summer, for over a month we were under a—first, a Stage One, and then I think we reached a Stage Two air pollution alert from the wildfires. And this meant that all of the football teams weren't practicing, they were encouraging people with breathing problems to stay indoors.

I mean, this went on for weeks and weeks in our community, a very immediate public health issue because of the wildfires' smoke. So there is no doubt that when you are in these wildfires and in the downwind of these smoke plumes, it is an immediate health issue for the public.

I think the longer term of where we have structures built, it is very much like people building all of the coastline houses in the hurricane areas with sea level rise. The same thing. We have allowed structures to be built in places that are nondefensible, and

I think we are reaching that same sort of issue in the forested land around the country with this fire issue now.

And I think while I have the mike, I will certainly reiterate also in the long run, only reducing our fossil fuel emissions is going to get us ahead of this problem.

Mr. CLEAVER. So, yeah, essentially you are saying that there could be some damage to the human creature as well as the other creatures and that, you know, being the United States, we have the constitutional right to be stupid.

Mr. RUNNING. That is correct.

Mr. CLEAVER. Thank you, Mr. Chairman.

The CHAIRMAN. We thank each of our witnesses.

Let's ask you to do this, in reverse order, and I will tell you what we will do: We will allow the gentleman accompanying you, Mr. Francis, to also give us—give us the 1 minute you want us to each remember about this relationship between global warming and wildfires. And try to summarize in 1 minute the parting shot that you want us to each remember.

Mr. DELUCA. Climate change is causing an increase in the occurrence and size of wildfires in the United States. Wildfire, on the other hand, is a natural process that is necessary in our forest environments. Wildfires should be allowed to burn in natural landscapes that are far from the community zone and that have the opportunity to reinvigorate those forests and reduce the fuel loading in those forests over the long term and maintain the healthy vigorous forests that Gail Kimbell referred to today.

Intense efforts should be made in the wild land urban interface to reduce the fuel loading and protect those structures and the fire fighters and people's lives.

The CHAIRMAN. Thank you, sir.

Mr. Francis.

Mr. FRANCIS. I will pick up from where Tom left off about the wild land urban interface. We need to be—in this next century, in order to protect our population and protect the people, we need to be concentrating our resources into the wild land urban interface in and around these communities. We also need to be providing resources to the local communities to be able to help themselves, and doing that through the State Fire Assistance Program is one of the things that we mentioned in our testimony. The fact is, communities working together and doing the planning for their own protection and their own survival is an important aspect. And it is where you get that type of project that doesn't get appealed when you have the community participation collaboration.

The CHAIRMAN. Thank you.

Dr. Medler.

Mr. MEDLER. Well, I would like to continue off some of those thoughts and go back to some of the questions. We have huge areas in the back country that are going to burn, proscribed fire, controlled fire would probably involve less smoke. And there is a tricky decision that is going to need to be made there.

Last year, the San Diego Declaration on Climate Change and Fire Management was formally ratified at the third International Fire Ecology and Management Congress. So we had over 1,200 people there, scientists and managers. This historic document really

presents a synopsis of the best available science and efforts of climate change and wildfire scientists, and we provide with that a list of action items. And I would like to enter the full San Diego Declaration into the record along with my testimony.

[The information follows:]

THE SAN DIEGO DECLARATION ON CLIMATE CHANGE AND FIRE MANAGEMENT

THE ASSOCIATION FOR FIRE ECOLOGY

Presented at
3RD INTERNATIONAL FIRE ECOLOGY AND MANAGEMENT CONGRESS [1, 2]
November 13-17, 2006

PREAMBLE

As scientists and land managers who focus on fire and its effects on natural ecosystems, we recognize that climate plays a central role in shaping fire regimes over long time scales and in generating short-term weather that drives fire events. The science surrounding human-caused climate change continues to strengthen and the weather patterns that shape the ecosystems where we live and work may be altered dramatically over the coming decades. In anticipation of such changes it is important to consider how fire management strategies may enable us to respond to a changing global climate and thereby reduce potential disruptions to plant communities, fire regimes and, ultimately, ecosystem processes and services.

Currently, we are observing serious wildland fire conditions, such as increasing numbers of large and severe wildfires, lengthened wildfire seasons, increased area burned, and increasing numbers of large wildfires in fire-sensitive ecosystems (*e.g.* tropical rain forests and arid deserts). Recent research suggests that these trends are, in part, related to shifts in climate.

As temperatures increase, fire will become the primary agent of vegetation change and habitat conversion in many natural ecosystems. For example, temperate dry forests could be converted to grasslands or moist tropical forests could be converted to dry woodlands. Following uncharacteristically high-severity fires, seedling reestablishment could be hindered by new and unsuitable climates. Plant and animal species already vulnerable due to human activities may be put at greater risk of extinction as their traditional habitats become irreversibly modified by severe fire. Streams and fisheries could be impacted by changing climates and fire regimes with earlier peak flows, lower summer flows, and warmer water even if ecosystems don't burn. Finally, extreme wildfire events and a lengthened fire season may greatly increase the risk to human lives and infrastructures, particularly within the wildland urban interface.

We acknowledge that there are uncertainties in projecting local impacts of climate change, however, without taking action to manage fire-dependent ecosystems today and in the absence of thoughtful preparation and planning for the future, wildland fires are likely to become increasingly difficult to manage.

We, the members of the Association for Fire Ecology that endorsed this document at the 3rd International Fire Ecology and Management Congress, support the following considerations for planning and management to enhance ecosystem resiliency to wildland fire in a changing global climate.

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[1] This declaration represents the position of the Association for Fire Ecology and other signatories and may not represent the position of other organizations or agencies sponsoring the Congress.

[2] During the Congress, the Association for Fire Ecology will provide this declaration to all Congress attendees for their individual and collective endorsement.

BACKGROUND

1. Both fire and climate regimes interact with other natural processes to direct the formation of vegetation in ecosystems. Given that climate and fire regimes are linked through vegetation, changes in climate can lead to large or small changes in fire regimes. Climate and fire regimes are also directly connected through the climate drivers of ignitions and fire weather. Climate influences both where and how vegetation grows and thereby creates the fuel conditions that drive fire frequency, intensity, severity, and seasonality. Precipitation and temperature patterns regulate the accumulation of fuels. In some ecosystems, wet years may promote "boom" vegetative (fuels) conditions, while drought years promote "bust" and the burning of the "boom" vegetation. Further, we know that the inevitable dry years, particularly when warm, are associated withy larger fires, both in size and number, especially where fuel is abundant. Fire can also contribute to the problem of increasing green house gas emissions because it is a source of CO2 and particulate emissions, which may affect local and regional air quality and worldwide climate.

2. Historical fire regimes have been disrupted in many ecosystems. Factors such as human activities and land development, loss of indigenous burning practices, and fire suppression have all led to a change in some plant communities historically shaped by particular fire regimes. Human activities have significantly increased the number of ignitions in many temperate, boreal, and tropical regions. Fuel loads have increased in some temperate forests where low intensity fires were historically the norm. In some rangelands, shrubs have been replaced by annual grasses or colonizing trees. Human caused burning has increased fire frequency in some tropical regions where fire-sensitive ecosystems dominate.

It should be noted that not all vegetation types have been significantly altered by fire suppression. Many shrubland ecosystems, such as chaparral, burn at high severity under extreme weather conditions and fire management in the 20th and 21st centuries has not appreciably changed their burning patterns. Coastal, mesic coniferous forests in the Northwestern US have not been modified to a great extent by fire suppression policies because fire rotations in this area are much longer than the period of fire suppression. In other forests such as Rocky Mountain lodgepole pine, high severity fires every 100-300 years are ecologically appropriate and fire suppression has probably not affected these ecosystems to a great extent. The ecosystems most impacted by fire suppression are forests that once experienced frequent, low-moderate intensity fire regimes; these ecosystems are probably the most vulnerable to altered fire regimes from changing climates.

Approaches to restore fire-adapted ecosystems often require treatment or removal of excess fuels (*e.g.* through mechanical thinning, prescribed fire, or mechanical - fire combinations), reducing tree densities in uncharacteristically crowded forests, and application of fire to promote the growth of native plants and reestablish desired vegetation and fuel conditions. Excess fuels are those that support higher intensity and severity fires than those under which the particular ecosystem evolved or are desired to meet management objectives. For example, in dry western US forests that once burned frequently, a high density of trees and a large surface fuel load often promotes crown fires that burn over very large areas. Some of these same forests once flourished under a fire regime where frequent, non-lethal low-intensity surface fires were the norm, and large-scale crown fires were rare. Managers should determine if forests can be restored to what they once were or if another desired condition is more appropriate. If it not appropriate to restore ecosystems to a previous condition because of expected novel climate conditions, then managers should develop new conservation and management strategies and tactics aimed at mitigating and minimizing uncharacteristic fire behavior and effects.

3. Climate change may interact with other human activities to further change fire regimes. For example, in much of the western US, since the 1980s, large fires have become more common than they were earlier in the century. This has often been attributed to increased fuel loads as a result of fire exclusion. However, a number of research studies suggest that climate change is also playing a significant role in some regions, elevations, and ecosystem types. In the western US, researchers recently identified an increase in fire season duration in mid-elevational forests. These changes were correlated with earlier spring snowmelt dates. With global temperatures projected to rise throughout this century, increases in fire season length and fire size can be expected to continue.

4. Climate change can lead to rapid and continuous changes that disrupt natural processes and plant communities. Are managers safe in assuming that tomorrow's climate will mimic that of the last several decades? Increased temperatures are projected to lead to broad-scale alteration of storm tracks, thereby changing precipitation patterns. Historical data show that such changes in past millennia were often accompanied by disruption of fire regimes with major migration and reorganization of vegetation at regional and continental scales. Exercises in modeling of possible ecological responses have illustrated the potential complex responses of fire regimes and vegetative communities. These exercises indicate that dramatic changes in fire regimes and other natural disturbance processes are likely. Indeed, some believe that the impacts of climate change may already be emerging as documented in widespread insect infestations and tree die-offs across some areas in the western US and British Columbia, and more rapid and earlier melting of snow packs. Developing both short- and long-term fire and fuels management responses that improve the resilience of appropriate ecosystems while reducing undesired impacts to society will be critical.

5. Changes in climate may limit the ability to manage wildland fire and apply prescribed fire across the landscape. Under future drought and high temperature scenarios, fires may become larger more quickly and could be more difficult to manage. Fire suppression costs may continue to increase, with decreasing effectiveness under extreme fire weather and fuel conditions. In some temperate and boreal regions, it is expected that more acres will burn and at higher severities than historically observed. In humid tropical regions exposed to severe droughts, vast forests could burn making it difficult for forest managers to prevent farmers from entering destroyed forests and establishing new farms. Globally, new fire regimes would be associated with shifts in ecosystem structure and function and likely, changes in biodiversity.

6. Approaches to fire management that recognize the potential for greater variability and directional change in future climates may help to reduce ecological and societal vulnerability to changing fire regimes. Such approaches are likely to improve fire management and ecosystem health. A goal could be to reduce the vulnerability, both ecologically and socially, to the uncertainties that accompany a changing climate. For example, if managers restore some forests as a means to increase ecosystem resiliency to climate change, they will also be improving biodiversity and protecting important forest resources. In the humid tropics, if managers make a concerted effort to prevent fire from entering rain forests during drought years, then they would be reducing the risk of future fires and illegal logging, even if droughts did not become more frequent and severe with a changing climate.

CONSIDERATIONS FOR MANAGEMENT, RESEARCH, AND EDUCATION

Recent changes in climate and fire patterns have been observed in many areas of the world, and current projections are that ongoing and long-term changes are likely. We believe that the actions outlined

below could help managers to be better prepared to anticipate and mitigate potential negative effects of variable and changing future environments.

Fire and Ecosystem Management

- Incorporate the likelihood of more severe fire weather, lengthened wildfire seasons, and larger-sized fires in some ecosystems when planning and allocating budgets, which traditionally are based on historical fire occurrence.
- Make use of both short-term fire weather products AND season-to-season and year-to-year climate and fire outlooks that are increasingly available from "predictive services" groups in federal agencies, and particularly the sub-regional variations in anticipated fire hazards that enable strategic allocation of fire fighting and fire use resources nationally.
- Continually assess current land management assumptions against the changing reality of future climates and local weather events.
- Develop site-specific scenarios for potential weather events linked to climate change and redesign fire management strategies to make room for rapid response to these events.
- Consider climate change and variability when developing long-range wildland fire and land management plans and strategies across all ownerships.
- Consider probable alternate climate scenarios when planning post-fire vegetation management, particularly when reseeding and planting.

Fuels Management

- Prepare for extreme fire events by restoring some ecosystems and reducing uncharacteristic fuel levels through expanded programs of prescribed burning, mechanical treatments, and wildland fire use to meet resource objectives. Burning under the relatively mild weather conditions of a prescribed fire produces lower intensity burns and, generally, less carbon emissions than would a wildfire burning under wildfire conditions. Burning and thinning treatments should be strategically placed on the landscape as the amount of effort to treat landscapes is large and payback can be relatively small. That is, treatments should be applied near values at risk. Some ecosystems will continue to burn in high severity stand replacement fires and this is appropriate for their sustainability.
- Incorporate emerging scientific information on the impact of changing temperature and precipitation on plant communities into fuels management project design and implementation at the local level.
- Expand wildland fire use at the landscape scale in fire-adapted ecosystems to restore fire regimes and reduce fuel loads. Be more aggressive in promoting fire use during lower hazard fire seasons, and fire use in landscapes that offer particular opportunities for relatively low-risk, large-scale burning. This will allow more acres to be burned under less extreme fire weather conditions than fires that might occur in the future under extreme heat or drought conditions.
- Control highly flammable non-native plant species and develop management options to address their increased spread and persistence. In some ecosystems appropriately timed prescribed fires can be used to reduce non-native species, in other areas continued fire exclusion may be the best management option. In other areas, reseeding and active restoration may be the best option.
- In some cases the removal and use of small diameter forest products (engineered lumber, pulp and paper, biofuels) and chipped fuels (for electrical energy generation) could be used to reduce fire hazards in appropriate vegetation types. Burning excess fuels in a co-generation plant has the additional advantage of producing lower emissions when compared to prescribed fires.

Research, Education, and Outreach

- Implement long-term biodiversity and fuels monitoring programs in the fire-adapted ecosystems that are expected to undergo the widest range of change and variability linked to climate change, such as those that once experienced frequent, low-moderate intensity fire regimes.
- Expand inter-disciplinary research to forecast potential fire season severity and improve seasonal weather forecasts under future climate change scenarios.
- Integrate the subject of climate change and its influence on ecosystem disturbance into curricula within natural resource management programs at the university, grade school, and continuing education levels.
- Disseminate information to the general public and government agencies regarding the potential impacts of changing climate on local natural resources and disturbance regimes, particularly those that interact with fire.
- Hold conferences or symposia to enhance communication among researchers and managers and to engage the general public in discussion on how best to adapt public land management to cope with fire in a changing environment.
- Form inter-disciplinary teams of researchers that include fire ecologists and climate scientists to identify and pursue emerging areas of climate and fire research.

The CHAIRMAN. Without objection, it will be included. And I thank you, Dr. Medler. It will be included in the record.

Dr. Running, the final word.

Mr. RUNNING. And the final word. I think what all of us as IPCC authors want to make clear to the public is that this warming trend we are on is human induced. We are already seeing the early signs of a whole scale transition of our entire landscape. Really what we are seeing with these wildfires is a natural process where a dryer ecosystem ends up being replaced because it can't be supported with the current climate that is now occurring. And the only way we are ever going to get ahead of this issue is to reduce our fossil fuel emissions down to rebalance the global carbon budget.

The CHAIRMAN. Thank you, Dr. Running. And again, congratulations on the role you played in helping the United Nations win the Nobel Peace Prize.

And we thank each of you for your contribution here today. This is a subject that I think over the next year we are going to return over and over again. It is a central part of the whole story line of global warming, the causation by human beings and its effect subsequently on human beings yet again. So we thank you. And with that, this hearing is adjourned.

[Whereupon, at 12:38 p.m., the committee was adjourned.]

U.S. Forest Service Reponses to Questions for the Record
House Select Committee on Energy Independence and Global Warming
Hearing on "Wildfires and the Climate Crisis"
November 1, 2007

Question 1a. What is the Forest Service doing to plan for the long term consequences of increased fires?

Answer: The agency is planning and providing for sustainable ecosystems through hazardous fuels treatments and other vegetation management activities to reduce the risk of catastrophic wildfires. In the context of the hearing, "Wildfires and the Climate Crisis," the Forest Service is actively engaged in addressing climate change. The Forest Service is developing strategies to mitigate the effects of climate change and continuing research on adaptation of our ecosystems that could occur with climate change.

Question 1b. What is the USFS doing to help communities deal with increased fire risks and reduce their vulnerability to wildfires?

Answer: The Forest Service operates several grant programs intended to assist states and local communities prepare for and lower the risk of wildland fire. Two important grant programs are State Fire Assistance (SFA), and Volunteer Fire Assistance (VFA). The SFA program supports the wildland fire prevention, mitigation and suppression services of the States, and VFA provides critical assistance to Volunteer Fire Departments and organizations in communities with a population of 10,000 or less. The Forest Service also provides assistance to localities to develop Community Wildfire Protection Plans. These plans identify priority areas for treatment to reduce the risk of wildland fire and its impacts.

Additionally, the Forest Service and the Department of the Interior conduct significant levels of hazardous fuels reduction projects in order to reduce vulnerability to wildland fire. The Forest Service and the Department of the Interior design hazardous fuels reduction and landscape restoration activities to meet one or more of three objectives:

A) Directly reduce wildfire threats within the wildland urban interface (WUI).

B) Treat areas outside of the wildland-urban interface (non-WUI) that are at greatest risk of catastrophic wildland fire.

C) Maintain desired landscape conditions achieved through previous treatments outside the WUI to retain the associated benefits.

Since 2001, over 26 million acres have been treated nationwide to reduce hazardous fuels. Of that total, 60% have been within the WUI.

Question 2a. Has the Forest Service focused on this issue of how the federal government can be a better partner to communities to keep them out of harm's way?

Answer: The Forest Service provides support to communities through several national initiatives designed to assist communities at risk from wildland fire. Examples include funding and technical support for the Firewise program, which helps communities reduce their risk from

wildland fire, and the Smokey Bear wildfire prevention campaign, operated by the Ad Council. Grant programs such as State Fire Assistance and Volunteer Fire Assistance directly support community fire department's preparedness to control wildfire. The Forest Service works with State Foresters to ensure these programs provide the maximum benefit possible to communities. A Community Wildfire Protection Collaboration Workshop for community, local, state and federal partners, jointly sponsored by the Forest Service and the Department of the Interior, was held in Reno, NV in March, 2008 to improve collaborative efforts to address wildfire protection for communities.

Question 2b. What tools do you have for communicating risk and implementing mitigation projects?

Answer: Community Wildfire Protection Plans, as established in the Healthy Forests Restoration Act, provide communities the opportunity to define their wildland urban interface boundaries, establish priorities and methods of hazardous fuels treatments surrounding the community, and influence federal funding and hazardous fuel treatment priorities surrounding the community. The Community Guide to Preparing and Implementing a Community Wildfire Protection Plan, which is currently under development, will provide many more tools, strategies and resources for communities to address risk and implement mitigation projects.

Question 2c. Are all of these tools voluntary?

Answer: Yes, these tools are voluntary. They are based on a collaborative approach which allows the interested and involved partners in a community to work together to identify and implement activities, actions and goals that are relevant, acceptable and will lead to reduction of risk in the local community.

Question 3. What recommendations do you have for how to fix the unsustainable situation in which the Forest Service has to pay for fire fighting costs by raiding other accounts?

Answer: We acknowledge that funding of wildfire management is a challenging issue, and we welcome a continuing dialogue on the topic. While the factors of drought, fuels build-up in our forests, and increasing development in fire prone areas have caused the costs of firefighting to grow in recent years, we are positive about our direction to address wildland fire suppression costs and are committed to action.

Though paying for extraordinary fire events has the potential to delay important agency work, we are addressing what is driving suppression costs before addressing how the agency pays for them. The Forest Service is adopting substantive management reforms to mitigate increased fire suppression costs. The Forest Service, Department of the Interior, and other first responders have spent significant effort and resources over the past several years to coordinate capability, improve inter-governmental communication, and employ management controls to ensure effective response. At the same time, we have increased attention to managing costs in these complex environments. These efforts are having an effect on suppression costs. For example,

USDA saw a decrease of over $100 million on suppression expenditures in 2007 compared with 2006, even though the size of wildfires and acres burned were greater.

Two recent bills have highlighted alternatives for budgeting wildfire suppression. Policy analysis for each of these needs to be examined relative to the implications on the Federal budget and potential offsets for increased mandatory spending. The Administration has not submitted any proposal to change the method for budgeting for fire suppression and, consistent with the current and previous Administrations' policy and historical practice, the Departments will continue to budget for fire suppression costs using the 10-year average. This approach is also consistent with the way other Federal agencies, including those in the Department of Agriculture and the Department of Homeland Security, budget for disasters and emergencies where future costs cannot be predicted.

As we work together on this issue, the Departments will continue to work closely to meet the challenge of rising suppression costs. A number of positive steps have been taken, including emphasizing land management decisions that affect fuel loading and resource protection, advancing integrated data management, providing clarification for master cost-sharing agreements, and developing metrics and accountability measures to evaluate managerial cost effectiveness. Both agencies also use Appropriate Management Response (AMR), which provides risk-informed fire protection by introducing the concept of managing wildfire in relationship to the risk that the incident poses.

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May2, 2008

From:
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TO:
Ali Brodsky
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Hello Ali,

Please forgive me tardy response to you question below. I was traveling for Spring Break, and your email fell into an almost infinite junk email folder that I only recently examined. I hope my response is not too late to be of service.

Your question was…

> 1. I appreciate your statement that construction standards, fire defensible perimeters around structures, and zoning are necessary. These are traditionally locally driven actions. Do you have any specific ideas for how the Federal government can be involved to help communities make better decisions? Would there be a way for the Federal government to require, or at least provide incentives for, better zoning and construction standards at the community level?

In response I consulted with several collages, and we agree that it is a difficult proposition. However there are answers. I have included a power point show produced by Dr. Jack Cohen, a Research Physical Scientist, at the Rocky Mountain Research Station. This presentation does a great job of going over some of the fundamental problems with fire and community protection.

I have been doing considerable research on the ownership patterns in the fire-prone communities in the Western US. What becomes very clear is that most of the lands in question are not federal lands. I do think that there may be a role for FEMA to channel some "pre-mitigation" grants and loans to private homeowners/communities for fireproofing their homes. I also believe that a great deal more money could be made available to these communities in the form of other grants

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that can be used specifically for mitigation efforts in a precisely defined community protection zone, which is in the immediate vicinity around these communities.

Please fell free to contact me for any more information you may need.

Sincerely,

Michael J. Medler