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Hearing to Review Past Wildfire Seasons to Inform and
Improve Future Federal Wildland Fire Management Strategies

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

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

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

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

My testimony has five main points:

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

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

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

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

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

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

The cause of megafires

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Strategic location of restoration-based fuel reduction treatments is essential

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

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

Evidence exists that such an approach works.

Evidence from Arizona

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

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

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

The results indicate that treatment scenario B (treatments only in WUI) would have reduced crown fire potential across the landscape by 12 percent and flame lengths by 6 percent. In contrast, treatment scenario C (treatments in all high risk areas) would have reduced crown fire potential by 40 percent and flame length by 30 percent. This analysis supports the conclusion that the risk of megafires is best addressed by not only treating around communities, but by treating away from them as well in the greater landscape as a whole.

How Arizona dodged two bullets during the 2014 wildfire season

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

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

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

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

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

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

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

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

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

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