Committee on Natural Resources Subcommittee on Oversight and Investigations
Oversight Hearing September 27, 2017

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Questions for the Record (QFR) Statement

1. Please elaborate on Southwest forest ecosystems with regard to fire and active management.

In low-mid elevation ponderosa pine and mixed-conifer forests of the southwest, natural historical fire regimes were typically dominated by low/moderate-severity fire, but included the occasional high-severity fire patches as well. Because of this heterogeneity in fire effects, forests historically were quite variable in tree density, ranging from open to dense. This characterization is based on fire-regime reconstructions using historical field data (Odion et al. 2014, Williams and Baker 2014), fire-scar records from tree rings (Roos and Swetnam 2011), and paleoecological research using charcoal deposits (Jenkins et al. 2011). During warm, dry periods, especially following wet years, "large crown fires" occurred periodically in these forests historically (Roos and Swetnam 2011). Although there is currently considerably less fire in southwestern forests than historically, similar to other western U.S. conifer forests (Roos and Swetnam 2011, Odion et al. 2014), annual area burned has increased from the 1970s through 1980s. Importantly, high-severity fire in the southwest, as in most other western conifer forests (Roos and Swetnam 2011, Odion et al. 2014), has not increased in total acres or percentage of fire acres from 1984 to present, the period during which we have good satellite data (Baker 2015a, Keyser and Westerling 2017).

Though some southwestern forests have high densities of very small, the largest recent fires in southwestern forests, such as Horseshoe2 fire of 2011 (226,000 acres), Wallow fire of 2011 (564,000 acres), and Whitewater-Baldy fire of 2012 (307,000) have nevertheless been comprised mostly of low/moderate-severity fire effects (www.mtbs.gov). In the high-severity fire patches, post-fire forest regeneration has occurred naturally. Conifer establishment occurs in more dense concentrations closest to low/moderate-severity areas, and in more open patterns in the interior areas of larger high-severity patches (Haire and McGarigal 2010). In general, these mixed-severity fires in this and other fire-dependent forests support high levels of biodiversity (DellaSala and Hanson 2015). Mexican spotted owls, for example, preferentially hunt in such fire areas, due to increased small mammal prey abundance.

Contrary to Representative Gosar's false assertion during the hearing about the lack of pine regeneration in high intensity burns in the southwest, a new study was covered on October 5 in the Arizona Daily Sun that shows this is clearly not the case for these forests - http://azdailysun.com/news/local/study-finds-surprising-ponderosa-regrowth-after-severe-wildfires/article_7569e37f-d7ac-577f-b301-c9b640d2bd60.html#tncms-source=home-top-story-1

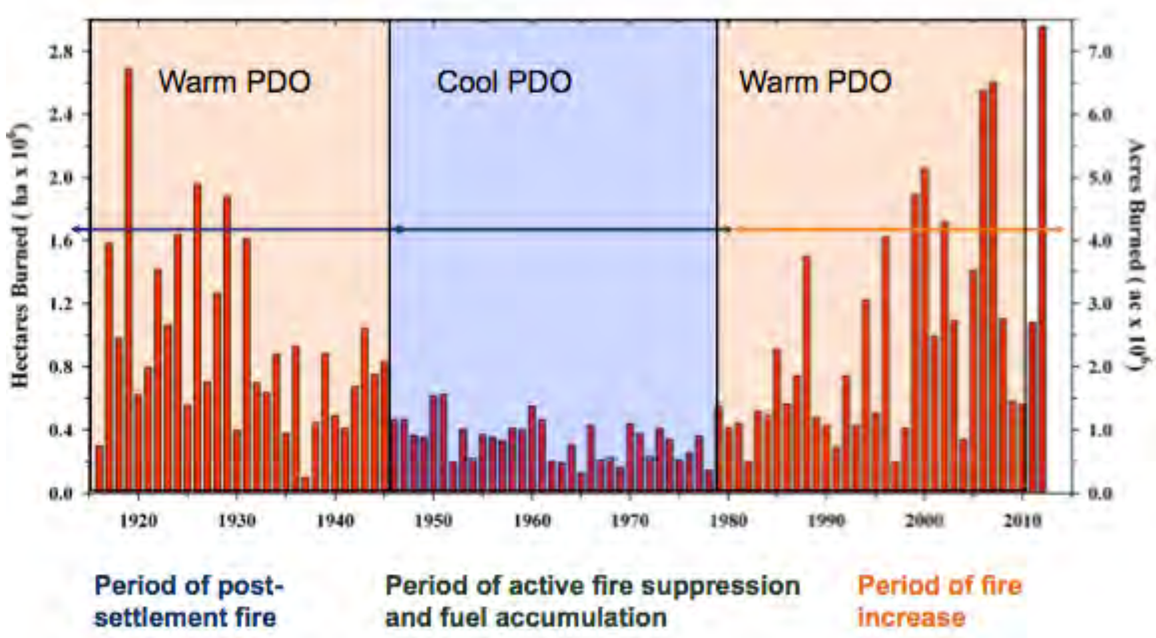
Finally, active management is defined and discussed in detail in the following sections.

2. Please further explain the graph about warm and cool phases to address the claim that the lower levels of fire correspond with periods of most active management.

Scientists have known for sometime that wildfire activity tracks regional droughts and high temperatures (Whitlock et al. 2015) influenced mainly by climatic forces such as the Pacific Decadal Oscillation (PDO), the El Niño-like pattern of alternating warm and cool phases in the Pacific region.

Congressman Westerman contended that the period when fewer acres burned in the cool mid 20th century PDO (Chart 1) was due to higher levels of logging or active management. If increased logging was the driver of fewer acres burned, then that pattern would have continued through the height of logging in the 1970s-1980s (Chart 2). Indeed that is the premise of the Westerman bill— that more logging will reduce fire risk. However, as active management ramped up in the 1970s through the early 1980s, **fire activity increased, not decreased**. And this trend of increasing fire continued despite mechanized fire suppression. The period of time that Congressman Westerman referred to included the near wholesale liquidation of mature and old-growth forests, decimation of steams and watersheds, sediment loading of streams and loss of native fish runs. In the Pacific Northwest, ~2 square-miles per week were being clearcut on national forests during this time (DellaSala et al. 2015). Logging also increased on private lands (Law and Waring 2015) yet acres burned continued to rise.

Chart 1. Area in western forests from 1900s through 2000s (J. Littell, personal communication).



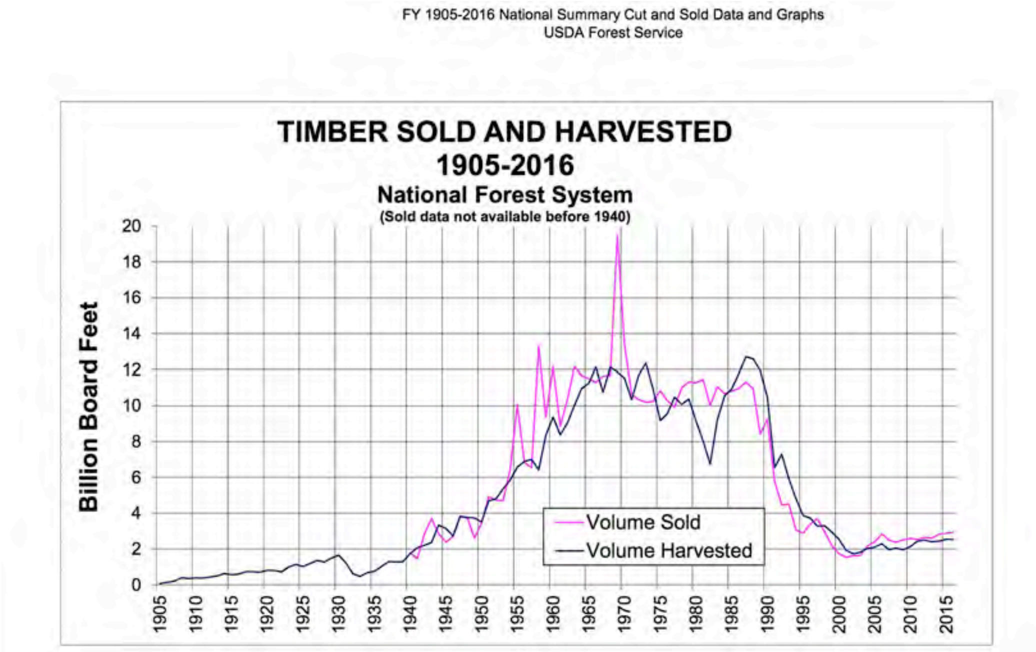


Chart 2. Timber sold and harvested over roughly the same period in Chart 1. Note an unprecedented increase in logging was taking place during the cool PDO (1950s-80s) when fire activity was low.

It is much more likely that regional climate – governed by top-down global climate forces – is mainly responsible for contemporary increases in acres burning (Little et al. 2009, Schoennagel et al. 2017). Additionally, recent increases in human-caused fires has made the length of fire season 3 times longer than the lightning caused season, contributing to an average of 40,000 fire starts each year as more and more homes are built in the Wildland Urban Interface (Balch et al. 2017).

3. What is your definition of and approach to active management and its role in wildfire management? What is your definition of "catastrophic" and how does it relate to fire management?

Active management – Witnesses or congressional members never defined this term at the hearing; however, HR 2936 would expand hazardous fuels (thinning) treatments and Categorical Exclusions for postfire logging that have nothing to do with forest resilience as follows.

- *Post-disturbance clearcut ("salvage") logging* – clearcutting of large swaths of live and dead trees after a natural fire or other natural disturbance. Postfire logging is often followed by herbicides to reduce competition from naturally regenerating shrubs and other plants, and to allow for subsequent planting of nursery stock trees. Logging and replanting, rather than letting the forest naturally regenerate, can create a dangerous feedback loop where fires burn initially and naturally in fire-resilient native forests that are then logged and planted in dense rows only to burn hot and to be logged and planted again, and so on (Odion et al.

2004, Thompson et al. 2007). Logging after a disturbance also removes the most ecologically valuable components of a forest – dead still standing trees ("snags") and fallen, downed logs. These legacy trees anchor soils, provide shade for developing seedlings, "nurse logs" for new plant growth and soil moisture retention, habitat for aquatic species when snags fall in streams. Importantly these legacies store vast amounts of carbon, decay and some release of carbon occurs slowly from decades to centuries. They also provide habitat for scores of insect eating bats, birds, and other small mammals that help keep native insect populations in check.

- *Forest thinning* – partial removal of trees used for a variety of silvicultural purposes, including reducing competition among tree stems, increasing tree vigor, and accelerating tree growth for so-called "forest health" (typically undefined or based on timber harvest definitions) purposes, including reducing "hazardous fuels." Thinning small diameter trees from below while maintaining appropriate canopy cover can in certain circumstances change fire behavior. However, there are some significant drawbacks to relying on landscape-scale thinning to address increased fire activity in a warming period. These are: (1) there is a very low probability (2-8%) that a thinned site will encounter a fire during the narrow period of 10-15 years of reduced "fuels;" (2) excessive thinning can increase wind speeds in a stand that consequently increases rates of fire spread; (3) opening up a stand to greater light penetration results in rapid understory growth that in turn contributes to future fire spread; (4) thinning needs to be followed by prescribed fire; and (5) thinning can damage wildlife habitat because it often removes medium and large diameter trees. When extreme fire-weather (high temperatures, low fuel moisture, low humidity, high winds) encounters a thinned stand there can be little to no reduced fire intensity (Schoennagel et al. 2017). In a warming climate, thinning will become increasingly less effective.
- *Road building* – Thinning and post disturbance logging require an expansive and expensive to maintain road system. Roads are associated with water quality degradation, aquatic species declines (e.g., salmon), spread of invasive weeds, human-caused fire ignitions, and loss of wildlife habitat (Ibisch et al. 2017).

Excluding the above "active management" provisions that are incompatible with forest resilience, there are plenty of approaches that would be supportive of resilience, including:

- Removal of human-caused stressors to ecosystems that compound in space and time (e.g., livestock grazing, Off-Highway Vehicles);
- Removing damaging roads and re-contouring the road prism to natural features to reduce sediments to streams and to improve hydrological function;
- Reintroduction and management of viable populations of endangered species and their habitats;
- Removal of invasive species;
- Managing wildfires for ecosystem benefits with prescribed fire in appropriate forest types;
- Thinning and girdling of small trees in young plantations created by prior clearcuts to accelerate development of older forest structures.

- Replacing ineffective culverts (especially important in areas where climate change will trigger more floods); and
- Restoring floodplains so they can naturally store more water (e.g., by reintroducing beavers) and attenuate floods.

Catastrophe – A natural disturbance that wreaks havoc on human communities is a catastrophe that needs to be avoided. However, the term "catastrophe," as repeated by witnesses and congressional members throughout the hearing has no scientific basis; it is value-laden and inconsistent with how ecosystems function.

Wildfires do not "destroy" fire-dependent ecosystems, rather, they are natural disturbance agents that have been shaping the ecology of forest ecosystems for millennia. Many forest ecosystems are uniquely adapted to reoccurring fires that rejuvenate them. For instance, certain lodgepole pine populations in the Rockies require intense heat to open their pinecones (serotinous) and release the seeds. The real ecological calamity is the wanton destruction of mature and old-growth forest ecosystems (~ 2% remains in the lower 48 states with most concentrated in the Pacific Northwest where >80% were destroyed by logging – Strittholt et al. 2006), and logging of irreplaceable postfire habitats that would expand under HR 2936. Those catastrophes are human-caused and have triggered widespread declines of hundreds of plants and wildlife, including the culturally iconic Pacific salmon (FEMAT 1993). Thus, the term catastrophe should be reserved for only the affects of natural disturbances on people, not ecosystems.

4. Please expand on your statement that logging, not fire, is the real threat to spotted owls.

In 2006-2008, I served on the U.S. Fish & Wildlife Service recovery team for the threatened northern spotted owl. I also have conducted independent field research and published on the habitat needs of the owl in scientific journals (e.g., see DellaSala et al. 2013). During the oversight hearing, I responded to erroneous claims made by Mr. Fite that forest fires – not logging – were the main threats to owls and that to save the owl we needed to reduce fires by "active management" (i.e., more logging). I was surprised to hear Mr. Fite's was concerned about the owl given that the timber industry has been responsible for liquidating most of the old-growth forests within the owls' range. Rather than acknowledge that logging has been the major reason for habitat loss, Mr. Fite blames wildfire. To begin, the owl would not have been historically present in dry forest regions of the Pacific Northwest unless it could co-exist with forest fires that periodically maintained owl habitat (see Baker 2015b).

When I was on the northern spotted owl recovery team, there was considerable debate among recovery team members about whether wildfire was a significant threat to owls. In fact, the U.S. Fish & Wildlife Service was criticized by scientific societies such as The Wildlife Society and Society for Conservation Biology in peer review for overstating fire risks to owls. Most recent studies show that spotted owls in the dry forest portion of their geographic range (e.g., southwest Oregon) are quite resilient to forest fires, but only if owl territories are not logged postfire (e.g., Clark et al. 2013). Wildfires of mixed intensities produce what is commonly referred to as the “bedroom” and “kitchen” effect with the bedroom being low-moderate severity patches where most large trees (nest sites) survive and the kitchen being the high severity burn patches (most trees killed) that provide owl-prey habitat for small rodents and woodrats that readily populate burn patches after fire (e.g., Bond et al. 2013).

Mr. Fite also mentioned a recent study in the King fire area of California where spotted owls abandoned territories postfire. What he failed to include is that owl populations in that area were already declining from extensive pre-fire logging. In fact, most of the owl territories that were erroneously claimed by the Forest Service to have been rendered “extinct” by the King fire had actually lost occupancy prior to the fire’s occurrence due to extensive logging (Hanson et al. in peer review). Owls also abandoned nest sites following substantial post-fire logging in their home ranges. Mr. Fite also failed to mention another published study in the Sierra that examined spotted owl occupancy after the Rim fire of 2013 on the Stanislaus National Forest. This study found that occupancy of spotted owls after the Rim fire (but before post-fire logging) was the *highest* of any location studied in the Sierra (Lee and Bond 2015). Thus, large fires can potentially benefit spotted owls, not harm them, so long as post-fire logging does not occur in the owl habitat. Fire is not the main problem for spotted owls (Baker 2015b), but rather postfire logging causes territory abandonment.

5. Please elaborate on the emissions associated with fire and forest fire and how carbon sequestration operates after a forest fire.

For the past two years, I have served on the Oregon Global Warming Commission’s Task Force on Forest Carbon that reports to Governor Kate Brown. The Task Force is about to release a new report – based on the latest emissions data – showing that emissions from wildfires typically represent only 1-3% of the state’s annual greenhouse gas releases.

Contrary to assertions at the hearing, the vegetation killed by forest fires does not completely volatilize or release most of its carbon to the atmosphere. Most of the carbon remains on site and is stored in the stem wood, branches, and logs unconsumed even by high-severity wildfires (Meigs et al. 2009, Mitchell 2015). A relatively small percent, from 5 to 35% (averaging ~10%) combusts in mixed severity fires typical of the northwestern US. Most of the combusted material is from burning of the duff layer, forest litter, small branches and small vegetation. About half of the burned carbon is stored in soils for ~90 years; the other half persists for over a thousand years (millennia) as charcoal. Importantly, large dead trees are not “consumed” by fire, rather, carbon remains stored in tree boles for decades to centuries at the same time new plant growth is rapidly sequestering carbon (Meigs et al. 2009, Law and Waring 2015). The claim made at the hearing, that the Rim fire resulted in emissions of over 12 million tons of CO_2 is wildly exaggerated. It was presumably based on an unsubstantiated assumption that 85% of the above-ground biomass is consumed in high-severity fires (see Garcia et al. 2017). However, actual studies of forest fires, based on field data, show considerably less consumption (~10% average). Additionally, even severely burned forests rapidly begin sequestering carbon during new forest growth (Chart 3).

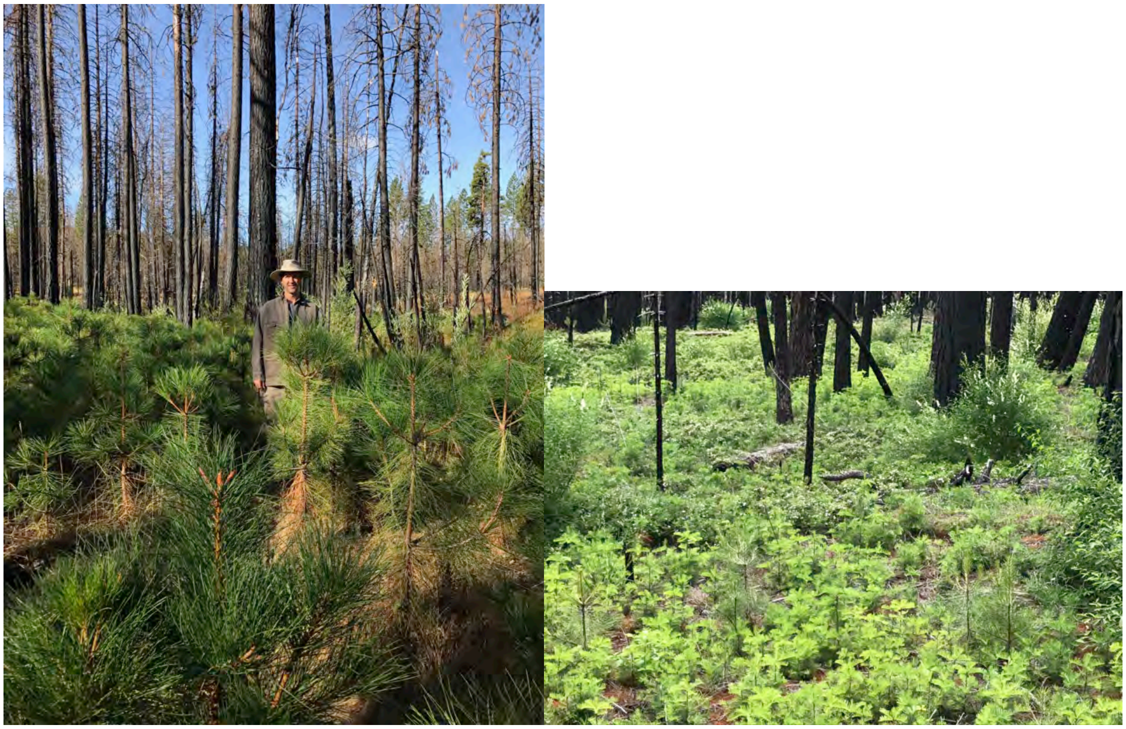


Chart 3. Natural post-fire regeneration in the Rim fire area 4 years post-fire. Note: extensive plant growth that corresponds to carbon uptake (photos: C. Hanson).

In contrast, tree removal via forest thinning and postfire logging reduces carbon storage (e.g., Chart 4). Further, because managers end up thinning much more area than actually would have burned during the period of treatment efficacy, there is much more carbon emitted from thinning and wood processing compared to what would have been emitted during a forest fire (Meigs et al 2009). In contrast, restrictions on federal lands logging in the Pacific Northwest, as a result of the Northwest Forest Plan protections, switched public forests from a source of emissions in the 1980s (the height of federal timber harvest) to a forest carbon sink that is now storing vast amounts of the region's global warming emissions (Krankina et al. 2012).

Chart 4. A human-caused catastrophic disturbance, postfire logging, on Stanislaus national forest in the Rim fire area, Sierra Nevada. Nearly all of the natural postfire conifer regeneration was killed by postfire logging. This activity would be expanded under HR 2936 with minimal environmental review (C. Hanson).

Thus, if this subcommittee is truly concerned about global warming emissions, then storing more carbon in forest ecosystems by increasing, not decreasing, protection of older carbon-dense forests and postfire forests would more than make up for the small contribution of wildfire emissions (Krankina et al. 2012, Law and Waring 2015).

6. Please discuss carbon storage and sequestration when it comes to forests, forest management and forest fires.

Carbon sequestration in relation to forest fires was discussed in #5 above.

Accurate assessment of whether a particular forest practice yields carbon benefits requires managers to conduct a full life-cycle analysis of carbon losses and gains. While this is beyond the scope of this question, I will elaborate in general on the movement of carbon into and out of a forest due to natural and human-caused disturbances. I will also provide an example of carbon flux from logging vs. protection of the Tongass National Forest in southeast Alaska where I have conducted such analyses. In sum, the simple answer can be boiled down to what Dr. Beverly Law (carbon scientist at Oregon State University) refers to as “slow-in” and “fast-out.”

In general, forests are a critical part of the global atmospheric carbon cycle that overtime contribute to climate stabilization by absorbing (sequestering) and storing vast amounts of carbon dioxide (CO_2) in trees (live and dead), soils, and understory foliage (i.e. "slow-in"). As a forest matures, it continues to accumulate and store carbon, functioning as a net carbon "sink" for centuries as long as there are no major disturbances. Ongoing carbon accumulation and storage have been measured in forests >800 years old (Luyssaert et al. 2008).

When an old-growth forest is cut down, up to two-thirds of its stored carbon (after accounting for carbon stored in wood products) is released as CO_2 switching it from a sink to a net "source" or "emitter" of CO_2 (i.e., "fast-out"). Carbon is quickly released via decomposition of logging slash, fossil-fuel emissions from transport and processing of wood products, and decay of short-lived wood products in landfills (Harmon et al. 1990). Planting or growing young trees does not make up for these losses. Indeed, after a forest is clearcut, it remains a net CO_2 emitter for its first 13 years and even if not cut down again will not reach the levels of carbon stored in an old forest for centuries (Turner et al. 2004) ("fast out").

Globally, deforestation (8-15% of emissions) and forest degradation (6-13% of emissions) contribute significantly to the world's annual greenhouse gas pollutants[1], more than the entire global transportation network, which is why many countries are seeking ways to reduce emissions by protecting their forest sinks via the Paris Climate Change Agreement. Thus, protecting carbon sinks and lengthening timber rotations would contribute to climate stabilization as well as other co-benefits such as clean water, climate refugia, fish and wildlife habitat, pollination, and outdoor recreation (Brandt et al. 2014).

As an example, I would like to refer the subcommittee to proposed logging alternatives on the Tongass National Forest (2016 forest plan amendment), the nation's largest forest carbon sink that annually sequesters about 8% of total US emissions. The agencies' preferred alternative would log 43,167 acres of old growth and 261,850 acres of young growth in the next 100 years, resulting in the equivalent emissions of ~4 million vehicles annually on Alaska roads. These estimates account for carbon stored in wood products and capture of carbon by forest regrowth. Tongass logging would release ~175 times more emissions than the "reference point" for project emissions recommended by the White House's Council of Environmental Quality (CEQ). Emissions would also result in a "social cost of carbon" estimated at >$100 million in global warming damages by the end of the century. These costs are ~10 times the projected timber revenues on the Tongass. In contrast, an alternative proposed by conservation groups (but dismissed by the Forest Service) would rely predominately on 76,000 acres of low controversy young growth timber to support the industry's transition out of old-growth logging. This

[1]These estimates are conservative as they were mainly derived for the tropics where the majority of forest losses occur – boreal and temperate forest losses and degradation also contribute significant emissions but are not included in these estimates. Intergovernmental Panel on Climate Change. 2007. Synthesis report. An assessment of the IPCC on climate change. Houghton, R.A., B.Byers, and A.A. Nassikas. 2012. A role for tropical forests in stabilizing atmospheric CO_2. Nature Climate Change 5:1022-1023.

alternative would yield a tenth of the emissions compared to the agencies' preferred alternative.

This kind of carbon analysis is completely lacking from HR 2936 that would instead greatly increase logging on national forests through the use of Categorical Exclusions (CEs) resulting in postfire clearcuts.

7. Please explain the science and efficacy of home ignition zone treatments.

Some 46 million homes now exist within the Wildland-Urban Interface (WUI) as development continues to push into fire-unsafe terrain (Rasker 2015). Ex-urban sprawl is now combining with human-caused fire ignitions associated with high road densities and development that is causing much of the escalating demand for and costs of suppressing wildfires. Passing these costs on to FEMA will not solve the problem of forest fire damage to structures as climate change and develop trigger more fire. What's needed are effective policies to address global warming pollution (e.g., US participation in the Paris Climate Agreement), land-use zoning to limit ex-urban sprawl in unsafe areas, and reducing fire risks to existing structures using proven methods (Chart 5 below). Logging outside this zone will not improve the chance that a home will be safe in a forest or grassland fire (Cohen 2000, Syphard et al. 2012).

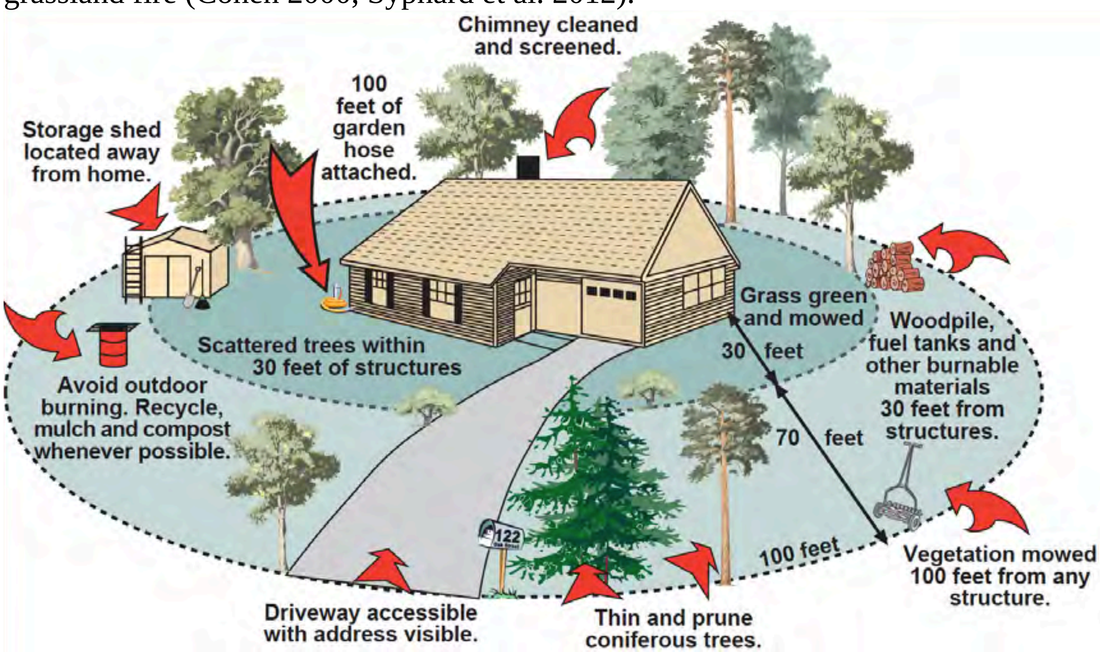


Chart 5. Homeowners' firesafe guide for Montana (2009).

As a homeowner myself, I participated in a community fire-wise project that concentrated vegetation treatments nearest home structures. Individual homes were retrofit with fire-resistant roofs, open vents were screened off to prevent entry points for firebrands, lower limbs of tree branches were pruned and removed from touching any structures, and flammable materials cleared from decking. In studies by scientists and insurance companies, homes treated this way would stand at least a 90% chance of surviving a wildland fire (DellaSala et al. 2015).

In sum, many scientists are increasingly recognizing that getting to co-existence with fire is a must (e.g., Moritz et al. 2012, Schoennagel et al. 2017). This means concentrating treatments within the WUI closest to homes, so that wildfire can be reintroduced safely in the backcountry away from homes.

8. Why do you believe that it is important for the public, and independent scientists such as yourself, to be involved in forest management decisions on federal lands through the full NEPA process?

As a scientist and citizen, I strongly support public and scientist involvement in forest planning decisions as vital to our democracy and to disclose a project's impacts negative or positive so that the public is well informed and can then weigh in to make those projects better.

Notably, it is not just environmental groups that use the public involvement opportunities that NEPA affords; the forest products industry (e.g., AFRC) also participates, including objecting and litigating.

First, with respect to the assertion that there is too much NEPA litigation, according to a GAO (2010) report on projects promoted as fuel reduction (2006-2008), only 2% of those projects were litigated. The few projects litigated were because the Forest Service did not obey the laws passed by Congress or did not use the best available science.

For example, conservation groups on the Siuslaw National Forest in Oregon have not filed an appeal since the Northwest Forest Plan (1993) shifted logging out of old growth and into thinning prior clearcuts. Similarly, there have been virtually no appeals or litigation in over a decade in Colville and Wenatchee-Okanogan National Forests due to a shift away from old growth logging.

Provisions in the HR 2936 that would severely limit science based review and public input in forest management, would create more not less controversy. Below are a few examples where the NEPA process has improved project design and implementation and others where irreparably harm to the environment was disclosed due to citizen involvement.

Lost Creek Boulder Creek Project and Middle Fork Weiser River Project, Payette National Forest, Idaho – two landscape scale projects were developed in partnership with the Payette Forest Collaborative (PFC). For each, the agency developed alternatives based on "fuel" treatments, wildlife habitat, and fisheries. The collaborative recommended combining the best of each alternative emphasizing watershed restoration and fuel treatments. The agency's final decision was a combination of the best parts of alternatives that was more responsive to community concerns than a "one-size fits all" single alternative that would otherwise occur under a CE.

Crystal Clear Timber Sale EA, Mt. Hood National Forest, Oregon. This was a straight forward timber sale of 12,725 acres presented to the Wasco Collaborative Group with a reoccurring theme of "if the area was left unlogged, the trees *might* die from insects, disease or fire" (emphasis added). The project lacked a proper environmental and economic analysis, most notably, it would impact spotted owl habitat, degrade naturally dense wet forests though wholly inappropriate logging, and increase fire risks resulting from the proposed removal of fire-resistant trees while leaving logging slash on the ground. The project is still in comment phase as the Forest Service considers appropriate changes suggested. If this project had been conducted under a CE, stakeholders in this national forest would not have had the most basic understanding of the details, or precise location of treatments, to be able to comment and require the Forest Service to properly disclose harm to the forest and wildlife.

Roseburg BLM District White Castle Project, Douglas County, Oregon – a pilot project was proposed to implement an "ecological restoration" approach using clearcuts in mature moist forests. The Court found BLM violated NEPA by not issuing an EIS, failing to consider a reasonable range of alternatives, and did not take the required hard look at the project's environmental impacts caused by clearcuts. If the project had gone through a CE, old-growth forests would have been clearcut and fuel hazards elevated with the public shut out of the process.

Jazz Thin, Clackamas River Watershed, Oregon – This project called for restoration of plantations through thinning 2,000 acres in moist mixed conifer to lower tree density. Conservation groups commented, appealed and litigated because most of the logging was within Riparian Reserves and Late Successional Reserves, and required building 12 miles of roads to "restore" this part of the forest. Additionally, because the project was analyzed through the NEPA process, local citizens were provided with location of the 82 thinning units as well as new roads that were being proposed. This enabled them to ground-truth the sale before logging commenced. Without this, citizens would not have been able to report to the Forest Service that many miles of roads were not being proposed for decommissioning, and culverts were not being removed as required. The Forest Service relied on this post-project monitoring to correct the problems and ensure the appropriate work was followed.

Sunny South, Tahoe National Forest, California – this logging project was conducted through a CE authorized the 2014 Farm Bill. Because it was categorically excluded from public involvement and analysis of harmful impacts including a range of alternatives to limit harm, the public did not find out until after the project's public notice was released that the project included intensive logging within five occupied California spotted owl territories. The Forest Service claimed to satisfy its obligation to "collaborate" under the 2014 Farm Bill CE provision by simply consulting the local logging industry. Given the magnitude of impacts, a CE was clearly inappropriate to properly assess environmental damages and inform the public of tradeoffs.

Conclusion:

The stated purpose of NEPA is "to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man…. NEPA requires federal agencies to assess whether certain actions significantly affect "the quality of the human environment." It was passed by Congress and signed into law by President Richard Nixon principally because the environment was being polluted, destroyed, and degraded by widespread industrial activities. NEPA includes CEs, defined as " a category of actions which do not individually or cumulative have a significant effect on the human environment." It was meant for small-scale projects, such as campground modifications and installation of toilets, not large-scale logging projects that harm the environment as currently proposed by HR 2936. In sum,

- The NEPA process, including the opportunity to object, is an important avenue for public participation —it works to ensure the agency takes input from the public in managing public lands, and does not ignore or dismiss that input arbitrarily. Under a CE, there is very little or no opportunity for meaningful input from the public.
- NEPA alternatives provide a critical tool for the Forest Service to design a project and evaluate its effects on the environment so that the public can be properly informed about how decisions are made and whether changes are needed to minimize harm to the environment.
- Collaboratives do not replace the importance of NEPA. Only NEPA requires agencies to incorporate public comment and/or respond to it. Moreover, some collaboratives have failed because of the agency's unwillingness to meaningfully incorporate input from the public in structuring alternatives.
- The vast majority of projects are not litigated and are benefited from public and scientific input. A minority of projects is litigated because the agency is not following the law.

Thus, in reducing the decision making authorities of NEPA to a binary response – action vs. no action – HR 2936 is inconsistent with the principals of a democratic society, shuts the door on public and scientist input, obscures otherwise transparent decision making in safeguarding the environment, and puts the nation on an dangerous downward spiral of environmental destruction not unlike the time before Congress passed the nation's landmark environmental laws (NEPA, ESA, Clean Water Act) that ensure our public lands continue to provide clean water, carbon sequestration, hunting and fishing and other outdoor recreation opportunities that the public strongly supports. Unless of course shutting the public out is precisely the goal of the sponsors and supporters of HR 2936.

9. Do wilderness restrictions prevent fire fighters from aggressively fighting fires and protect communities?

The short answer is no, absolutely not. This false statement was repeated at the hearing by witnesses and lacks a factual basis. There are no restrictions on fighting fires in wilderness except for provisions that require a Regional Forester's written permission to allow bulldozers. Wilderness fire management is about philosophy and guidelines, there are no laws, regulations, or other rules that I know of that restrict managers from deploying crews in wilderness. It all depends on each Forest Plan and the personal discretion of individual managers what will or will not happen in wilderness. Also, there is rarely any need to go into a wilderness to fight a fire because these areas provide opportunities to manage fire for ecosystems benefits consistent with the intent of the Wilderness Act. They are also generally far removed from human communities, and mainly in unsafe areas for firefighters because of steep terrain.

I also want to discount Mr. Fite's erroneous testimony about the Chetco Bar fire in southwest Oregon as his account of the fire contradicts the incident commander's informative reports of how fire was being handled. The reason the Chetco Bar was allowed to burn in the Kalmiopsis Wilderness is because the benefits of fire in maintaining ecological values, and the benefits of limiting firefighter exposure to the safety hazards of firefighting in the remote and rugged terrain of wilderness, outweighed the risk of fire spreading outside the wilderness and threatening other values. It was completely unsafe to place firefighters in harm's way in some of the most remote and steep country in the nation. The access points in and out, due to steep canyon country are limited, and dangerous to firefighters especially when fire was burning under 115 degree temperatures and 45 mile per hour winds, as was the case during periods when the fire was spreading.

10. The Chairman introduced a study into the record called "Carbon, Fossil Fuel, and Biodiversity Mitigation With Wood and Forests" in the Journal of Sustainable Forestry. Please respond to the study's assertion and compare its findings to the bulk of the scientific evidence.

I am a member of the Oregon Global Warming Commission's Task Force on Carbon (although these are my views only), and based on my understanding of the forest carbon life cycle analysis literature, the cited study is not supported by the wide body of scientific literature and uses unsubstantiated claims and calculations to reach bizarre conclusions that seem to defy the laws of physics. I cannot tell if it even went through peer review as no reviewers are acknowledged, which is customary practice for most journals. I recommend that the subcommittee dismiss this study.

One of the main reasons why this study is suspect is the authors appear to assume there are no carbon losses associated with the product lifespan of buildings by substituting wood for steel (that is – buildings store carbon indefinitely!). However, the general assumption for many *modern* buildings is that they will outlive their usefulness and be replaced within several decades. For instance Architecture 2030 cites the current average lifespan of buildings is 80 years, and suggests that over the next 20 years globally, we will build, tear down and rebuild ~900,000 billion square feet of buildings in urban areas (e.g., see http://architecture2030.org/buildings_problem_why/). That is a lot of carbon decomposing and being emitted to the atmosphere, as a building's "lifespan" is typically less than the carbon stored in an unlogged forest and carbon is emitted every step of the way through the wood processing chain. If the authors were to acknowledge the carbon emitted when buildings "decay," they would find that the product substitution benefit does not increase forever.

11. Do federal conservation designations like wilderness increase wildfire risk?

The short answer is no, absolutely not, and the reverse in fact is true given that fires burn hottest in intensively managed areas. During the hearing, there was a great deal of anecdotal information presented by witnesses about how active management can stop or slow down fires and how wilderness areas intensify fires. Some of that evidence was presented as photos on one side of the road (unthinned) vs. the other side (thinned) with claims made that thinning reduced fire intensity when in fact the forest type (lodgepole pine) was actually in a stand where forests are adapted to high intensity burns. Mr. Fite's testimony did not acknowledge the ecologically appropriate fire regime was indeed high intensity, not low intensity. He presented no data or scientific studies to back his assertions, just unsubstantiated claims about thinning based on two photos.

As a scientist, I deal with data, statistically representative sample sizes, robust analyses, and peer-reviewed science to guide my views on fire and forest management. The study that I cited by Bradley et al. (2016, I am a co-author) was the most comprehensive analysis ever done to address the management vs. protection question around fires and it went through rigorous peer review. To reiterate, we examined **1500 fires** using 4 decades of government fire records and conducted a massive computer (GIS) analysis of 23 million acres of burned areas to test the assumption that fires burn more intense in "unmanaged" areas (e.g., wilderness, national parks, roadless areas) compared to "actively managed" areas. What we found was the opposite – fires burned unnaturally intense in areas of intense management. This was most likely because logging slash and densely packed tree plantations promote intense burning (e.g., Odion et al. 2004).

In addition to the peer-reviewed studies, I presented Google Earth images to illustrate general findings about how heavily logged areas burn intensely while nearby remote areas burned less intensely during the same fire weather. To reiterate, logging does not stop or slow large forest fires burning under extreme fire weather but may, in fact, intensify fires.

12. Does public review of federal land management decisions increase wildfire risk?

No, absolutely not and please see my answer to the NEPA question #8. Public review of "hazardous fuels projects" has improved many projects while objections to projects are often because the projects would increase fire risks to communities, particularly those that reduce overstory canopy closure to unnaturally low levels (e.g., 30-40%), leave logging slash on the ground, do not follow thinning with prescribed burning, and remove large-fire resistant trees. Those project conditions are known to raise fire risks and are often included in fuel reduction projects by federal agencies. Under HR 2936, I would expect to see many more of these projects go through with minimal public input and environmental review.

13. Generally, younger trees grow faster than older trees. Does that mean we should cut down as many trees as possible to deal with climate change?

No, absolutely not, and this would result in increasing fire risks while emitting more carbon to the atmosphere via logging (also see Question 6). For example, in a peer-reviewed study, Law and Waring (2015) state,

"While some suggest that shorter rotations would provide more effective carbon sequestration (e.g. changing from current 80–90 year rotations to 40–50 years), research in the PNW [*Pacific Northwest*] shows that the total carbon accumulated from longer rotations is superior to that from e.g. 40- to 50-year rotations. When trees are harvested, the carbon released to the atmosphere from increased decomposition, and in the product chain needs to be accounted for when assessing carbon sequestration potential. There is considerable potential for increasing carbon sequestration in PNW forests by using longer rotations, particularly in those forests dominated by Douglas fir in climatically buffered areas, because they can continue, if undisturbed, to accumulate carbon for centuries."

The authors go on to state "If rotations in managed forests were extended to 100+years, the benefit would be significant in terms of carbon stocks per unit ground area."

Generally, higher levels of forest protection are associated with higher carbon storage (e.g., Mitchell et al. 2009), while logging reduces carbon storage. For instance, older forests globally store 30-70% more carbon than previously logged forests (Mackey et al. 2016). Thus, only a no-harvest approach would continue to sequester and store carbon long-term in forested ecosystems (Leighty et al. 2006, Krankina et al. 2012).

14. In his recent review of National Monuments, Secretary Zinke has proposed commercial logging in some National Monuments managed by the National Park Service. Will logging in National Parks decrease the occurrence or intensity of wildfires?

This is completely false for the reasons already stated. In my testimony (and Question 11), I cited a peer-reviewed study by Bradley et al. (2016) that examined this question using the largest dataset ever. As mentioned, national parks/monuments, roadless areas, and wilderness were characterized by fires that burned in lower intensities compared to intensively managed areas. This is corroborated by studies of fires in Yosemite National Park that burned in natural mixed intensity patterns compared to outside the park where fires burned more intensely (e.g., Miller et al. 2012). Secretary Zinke's call for commercial logging is clearly misplaced and will come with stiff opposition from the public that cherishes the few areas remaining in America where one does not have to view stump fields or large clearcuts. Again, the parks and protected areas are not the problem. Logged areas are the problem.

15. A ‘snag forest,’ which is created by patches of high-intensity fire, is important wildlife habitat. Can that habitat be recreated by clearcutting, as proposed in HR 2936?

As a scientist, I base my understanding of ecosystems on fieldwork, rigorous experimental design and statistical analyses of observations in nature. I submit my work to peer review to ensure that my assumptions are based on the best available science (peer review is the gold standard in science). My published work from the Sierra and Pacific Northwest regions shows that snag forests have comparable levels of biodiversity to the more heralded old-growth forests, yet snag forests are even rarer because they are frequently logged after a fire (Swanson et al. 2011, DellaSala et al. 2014, DellaSala et al. 2017). Snag forests with the highest ecological values are called “complex early seral forests” because, in part, they have abundant large “biological legacy” trees – live and dead trees remaining post-fire that “lifeboat” a forest through successional stages from young to old-growth forest. There is only one ecological pathway to a complex early seral forest – a severe natural disturbance in an older forest that kills most of the trees (Swanson et al. 2011).

Clearcuts before or after fire in no way resemble the complexity of a complex early seral forest because they lack the very structural elements – biological legacies – that a young forest needs to become established (DellaSala et al. 2014) (e.g., compare Chart 3 vs. 4). Clearcutting after fire (which would accelerate under HR 2936), damages soil horizons, requires an extensive roads network that delivers chronic sediment to streams and degrades water quality while killing fish spawning beds, can introduce exotic species to a site, and is often followed by herbicides, livestock grazing, and burning of slash piles (see Lindenmayer et al. 2008, DellaSala et al. 2015). Studies have shown that such logging activities after fire also kill most of the natural conifer establishment (Donato et al. 2006; also see Chart 4). Dense tree planting from small trees grown in tree nurseries then set the site up for the intense fire-logging-intense fire feedback system I discussed in Question 3. This type of logging produces biologically impoverished plantations and is inconsistent with the science of forest resilience.

16. Can you please tell us more about the ecological value of mixed-intensity fires, including large fires, for native biodiversity?

For over a decade, I worked on rainforest ecosystems internationally and in old-growth forests of the Pacific Northwest, British Columbia, and Alaska. Naturally, I trained myself to view forests as green and verdant. It was not until my 8-year old daughter and I took a hike in a large burn patch near my home in Ashland, Oregon that I began to question my own assumptions on what makes a forest, a forest. During our hike, she was excited to see how full of life the snag forest was because it included colorful flowering plants, small trees and shrubs, prolific butterflies, dragonflies, songbirds, bats, and woodpeckers – this was not an end but rather a beginning – a resetting of nature’s successional clock. As a scientist and father, I then began to look more closely at the complexity and beauty of nature after a large disturbance and decided to team with other scientists also studying post-disturbance landscapes to see if this phenomenon was consistent in other regions. What I found was surprising and exciting.

Large forest fires are not "catastrophes" of nature but rather produce a living tapestry of patch severities (fire effects on vegetation) that provide habitat for scores of wildlife across the full successional gradient – everything from woodpeckers that require severe burn patches and deer that live off the bounty of newly establishing plants to spotted owls that nest in the low-moderate burn patches and forage in severe patches (DellaSala and Hanson 2015). It turned out that my daughter was correct and I have been publishing on the importance of these forests in peer-reviewed journals since, including a book that I co-edited/co-authored and collaborated on with 27 scientists from around the world (DellaSala and Hanson 2015). In sum, the biodiversity after large forest fires is extraordinary and was found repeatedly in fire-adapted ecosystems of the American West, Canada, Australia, Africa, and Europe. And it was true for aquatic ecosystems as well, where intense fires produced a pulse of nutrients delivered to streams that within 1-3 years after fire was associated with increased productivity of aquatic invertebrates and fish, provided those areas were not logged as stated in Question #15.

I would invite any member of this subcommittee to take a walk with me in a burned forest before prejudging that these areas are ecological catastrophes. I will also bring my daughter along for further explanation as a budding scientist in training!

17. Some advocates for increased logging in national forests claim that there is scientific consensus that active management decreases forest fire extent, severity and impacts. As a scientist, would you agree that there is scientific consensus in this area?

Certain types of active management (e.g., thinning-from-below of small trees) may lower fire intensity but only under very narrow conditions and not during extreme fire weather (see Question 3). Other types of active management (pre- and post-fire clearcutting) compound disturbances to ecosystems for the reasons stated. In general, industrial-scale logging practiced in different regions of the country over different time periods has liquidated nearly all the nation's old-growth forests and is now poised to do the same for complex early seral forests, if logging proposals such as HR 2936 are passed. To reiterate, it is important to first define what active management means.

Notably, the claim about consensus was actually made by a non-scientist during the hearing – Mr. Fite. Instead, Bradley et al. (2016), using the largest analysis of data on this question ever conducted by scientists, found higher amounts of intense fire in actively managed areas.

18. Is there anything else you would like to add?

Public lands are the nation's best chance at maintaining intact and fully functional forests and watersheds that support clean water, carbon sequestration, habitat for fish and wildlife (huntable, fishable, endangered), pollination services, and outdoor recreation opportunities among other benefits. HR 2936 would turn much of the nation's forests into fiber farms populated by postfire clearcuts, artificially planted trees, and heavily roaded and damaged ecosystems that will burn more intensely in fires, compounding disturbances in space and time. HR 2936 is based on unfounded assumptions, has no scientific basis, and would prevent the public from having a say in how their public lands are to be managed. This QFA is an addendum to my testimony and a supplemental rebuttal to much of the misinformation presented by members of this subcommittee and the witnesses during the hearing that lacked any science credibility.

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