Testimony of Tania Schoennagel, University of Colorado,
U.S. House of Representatives Subcommittee on Federal Lands
Hearing on "Seeking Better Management of America's Overgrown, Fire-Prone National Forest"
May 17, 2017

Chairman McClintock, Ranking Member Hanabusa, and members of the subcommittee, I thank you for the opportunity to join you today to discuss fire and forest management.

I am a fire ecologist working as a research scientist at the University of Colorado since 2003. I received a PhD from the University of Wisconsin, and have been engaged in fire ecology research for over 20 years. I study the interactions of climate, wildfire, and bark beetles, and their effects on forests in the past and present, to help us understand possible future changes to forested landscapes in the western US. I also assess how different management decisions impact forest restoration and protection of communities from wildfire. I've worked with forest management and scientific communities in forests in Washington, Montana, Wyoming, and Colorado, in addition to conducting numerous studies related to wildfire across the West. I hope that applying what we know about changes in the western landscape to forest management decisions will help avert costs and surprises and promote resilient forests and safer communities in the West. I am passionate about making science relevant to the public and policy makers, and thank you for the opportunity to provide testimony based on my expertise on the topic of fire and forest management in the West.

In this testimony, I share information about how warming and wildfire have increased in the West and will continue to do so, compounding the risks and costs of wildfire in the coming decades. I explain that forest management likely will not meaningfully slow region-wide trends of increasing area affected by wildfire and bark beetles. Instead, I recommend strategically placing treatments in dry forest types, which are most likely to burn, and near communities, where they will help protect lives and property, will provide the greatest benefit to communities and ecosystems, and the highest return on investment. Overall, I urge policy makers to confront the challenge of helping communities and ecosystems adapt to inevitable increases in wildfire across the West.

The costs and risks of wildfire are rising.

In recent decades in the western US, federal, state and county policy makers, agencies, tribes, and community members are confronting longer fire seasons, more area burned, a tripling of homes lost to wildfire, and a doubling of firefighter deaths (1). Congress appropriated $1.3 billion for fire suppression and $504 million for fuels management per year on average from FY 2006 to FY2015 to help address these challenges (2). Fire suppression costs consume over 50% of the US Forest Service budget in big fire years (3), and the total cost to society may be up to 30 times more than the direct cost of firefighting (4). To contain these costs and reduce risks to communities, economies, and natural systems, we can draw on decades of fire science research in designing effective fire and forest management strategies.

Warming and wildfires have increased in the West and will continue to do so.

The western U.S. has already experienced significant increases in warming, wildfire and bark beetles, and will continue to do so in the coming decades. More wildfires and area burned in most forested ecoregions of the West are the result of rising temperatures, increased drought, longer fire seasons, and earlier snowmelt (5-7). Since the 1970s, the annual average temperature has risen almost 2°F and snow pack now melts 1-4 weeks earlier, increasing fire risk at high elevations (5, 6). This recent warming has lengthened fire seasons by almost 3 months (5), and when dry fuels are available for longer periods of time, more fires burn.

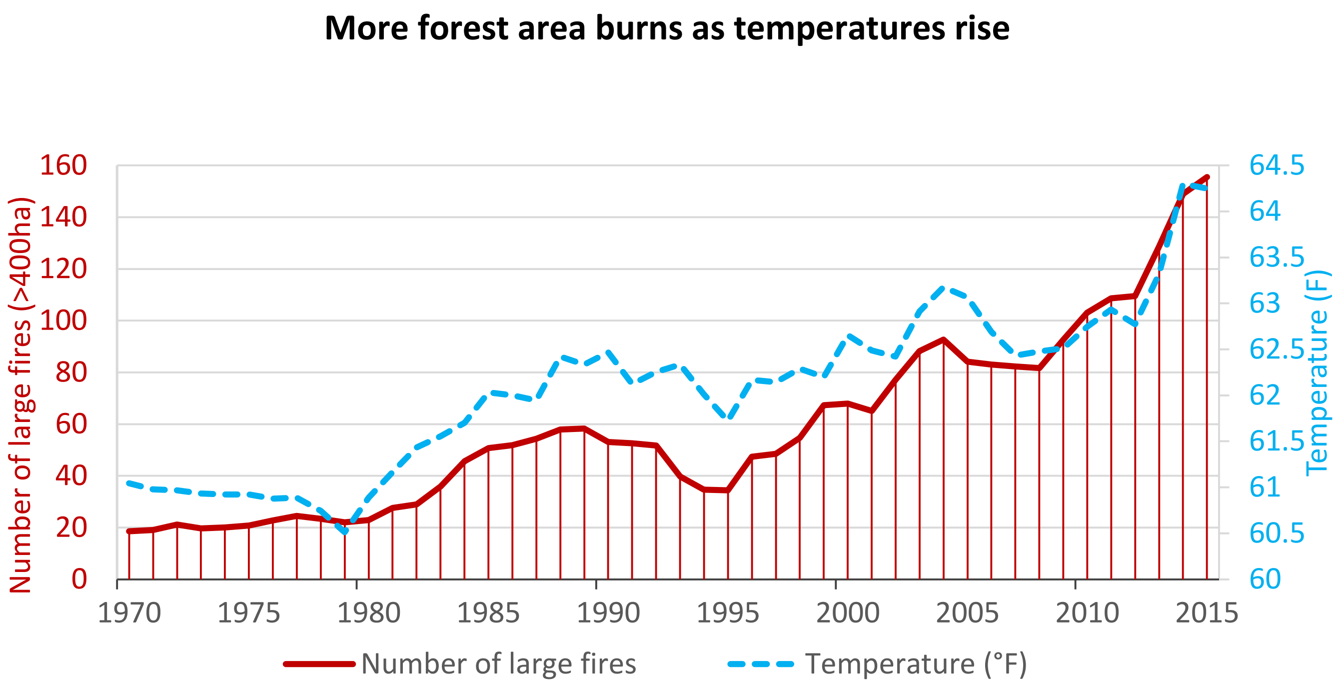

Fig. 1. The 9-yr moving average of annual number of large fires in western forests (adapted from (5)), and of March-August temperature (degrees F) in the West (NOAA, (8)).

As a consequence of recent warming, the West has experienced dramatic increases in area affected by wildfire and bark beetles. For example, the nine years with the largest area burned in the US since 1960 have all occurred since 2000 (9). In western forests, about 20 large fires burned per year in the 1970s and now well over 100 large fires burn per year; Fig. 1 (5). While the area burned in the West has increased significantly during this time, fire severity for the most part, has not. Most fires burn at low to moderate severity, and only forests in the Southwest, which are dominated by dry forest types, show a clear trend of increasing fire severity in recent decades (10, 11).

Like wildfire, native bark beetles are also very sensitive to warming and drought. There is strong scientific consensus that bark beetle outbreaks are triggered by warming and drought (12, 13). Simultaneous outbreaks across Alaska, British Columbia and the Western US reflect broad-scale, synchronous climate changes across the region.

The West is expected to warm another 2°F to 4°F, with significant further reduction of snowpack, in the next roughly 30 years (14, 15). Future warming will translate to even warmer summers, more drought, earlier snowmelt, longer fire seasons and, consequently, much more wildfire and insect activity in the West (16).

Regionally, fuel treatments cannot significantly alter the trend toward increased area burned

Forest fuel treatments typically thin forests to remove ladder fuels, decrease tree densities and open up forest canopies in an effort to reduce fire severity. However, the prospect for forest management to significantly reduce area burned in the West is very unlikely for a number of reasons. First, regional increases in wildfire closely reflect patterns of increased warming and drought (17-19). While the US Forest Service and Dept. of Interior treated 64.6 million acres in the US FY2001-2016 (20), wildfires continue to rise regionally with patterns of warming and drought (Fig. 1c). Second, forest management can only impact a portion of areas that experience fire, as less than half of the area burned in the West is in forests (18). Most areas experiencing wildfire in the West are grassland and shrublands, which require different management approaches. Finally, only about 1% of treated forests encounter wildfire each year—the large majority of federal fuel treatments do not encounter wildfire within their 10-20 period of treatment efficacy (18, 21). The low percentage of treated areas experiencing fire is not a consequence of the treatments, as wildfire must actually enter a treated area in order to modify fire behavior. Treated forests simply burn at a similar rate to forests in the West, which is only about 1% per year (18). As a consequence, most treated forests sit waiting for wildfire as the efficacy of the treatment wears off, then must be re-treated and/or prescribe-burned to maintain the possibility of reducing future wildfire severity.

A recent comprehensive study showed that although treatment encounters with wildfire are low, the percentage of treated areas that subsequently burn varies regionally and with size of the treatment (21). The authors of this report conclude that "simply treating more area may not help to achieve long-term fire and land management goals" and that "strategically placing fuel treatments to create conditions where wildland fire can occur without negative consequences, and leveraging low-risk opportunities to manage wildland fire will remain critical factors to successful implementation of the Cohesive Strategy."

Locally, strategic placement of fuel treatments can reduce fire severity and protect communities

Treatments in dry forest types can restore them and reduce fire severity

Forests are not all the same, and their likelihood and way of burning, and their responses to treatment, vary too (22, 23). Treatments to dry forest types, common in the Southwest, California, southern and eastern Oregon, as well as at lower elevations and on the drier east side of mountain ranges, can reduce fire severity and restore forests. These forests are commonly hot and dry and have historically experienced frequent, low-severity fire (about every 4-40 years). Modern fire suppression has contributed to build-up of ladder fuels and tree densities in dry forest types, resulting in uncharacteristically high-severity fire in these forests. Thinning and prescribed fire in dry forest types can help restore low tree density, reduce fuel continuity, lower fire severity. ***Prioritizing treatments in*** *dry forest types that are more likely to burn, and have experienced significant fuels build-up due to past fire suppression, would increase the efficacy of fuels treatments.*

In contrast to dry forest types, moist/cool forest types, which occur at higher elevations and on the moister west side of mountain ranges, support high tree densities and are often not warm and dry enough to burn, so fire occurrence is relatively infrequent (about every 100-300 years) and these rare fires naturally burn at high severity. Here, forest densities have changed little from their pre-suppression condition, so thinning does not restore these forests (22). Mid-elevation forest types across the west experience mixed-severity fire, and fall in between these two contrasting forest types. Restoration need and treatment efficacy in mid-elevation forests is variable and the subject of active debate. In short, because of the variety of forests in West: 1) not all forests are equally "out of whack" due to past fire suppression, and 2) the likelihood that treated forests will have the opportunity to reduce fire severity varies by forest type.

Treatments near communities and infrastructure protect people, homes and infrastructure

The wildland-urban interface (WUI), where houses and communities intermingle with or abut wildland fuels, has expanded tremendously in the past few decades, augmenting wildfire threats to people, homes, and infrastructure. In the West, the WUI was expanded over a quarter in size since 1990, and over 2 million homes have been added in that period. California, Arizona and Washington have the highest numbers of homes in the WUI, and California, Colorado, and Washington experience the highest proportion of area burned in the WUI; Fig. 2 (18). Almost 900,000 residential properties in the western United States, representing a total property value of more than $237 billion, are currently at high risk of wildfire damage (24). Although WUI fires are only about 15% of the area burned in the West (18), they account for as much as 95% of suppression costs (25), as they fundamentally change the tactics of fire suppression compared with fighting remote fires, due to the people and property values at risk.

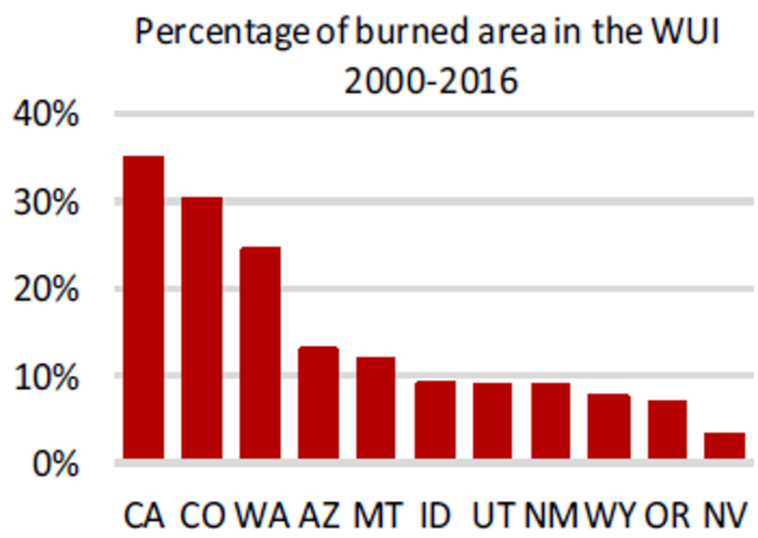

Fig. 2. Percentage of area burned by wildfires between 2000 and 2016 across the western United States inside the 2010 WUI including a 2.5-km community protection zone. About 15% of the WUI burned during this period, with largest proportions of the WUI burning in California, Colorado, and Washington (right).

Fuels treatments can be effective in reducing fire risk to residential communities and infrastructure in the WUI, if implemented close to these entities. Federally-owned land is only 20% of the WUI in the West, whereas the majority is owned by private landowners (70%) (26). Outside of the Wyden Authority and Good Neighbor Agreements, however, federal fuel management programs do not have jurisdiction to directly mitigate fire risk on private lands, where the threat to public safety and property is most acute. By some estimates, private land accounts for 52 million acres of forests considered to be at highest fire risk across the Western states (27). With two-thirds of the WUI being private land, federal agency ability to significantly reduce fuels and fire risk near homes and communities is limited. *Therefore, policies that facilitate treatments on private land, on a par with fuel-reduction efforts on federal lands, could significantly reduce fire risk to communities and valuable assets.*

Shifting more wildfire protection cost from federal to state, local, and private jurisdictions could also provide meaningful incentives to reduce risks before wildfires occur. Currently, much of the responsibility and financial burden for community protection from wildfire falls on federal land-management agencies. This arrangement developed at a time when few residential communities were embedded in fire-prone areas. Today, land-management agencies are overwhelmed by protecting vulnerable residential communities in a densifying and expanding WUI that faces more wildfire. In 2006, the US Government Accountability Office questioned the US Forest Service's prioritizing protection of homes that lie under private and state jurisdictions and has argued for increased financial responsibility for WUI wildfire risk by state and local governments (28). *Sharing wildfire protection obligations across jurisdictions could increase state and county incentives to limit further development into fire prone areas, and may encourage infrastructure investments in existing developments to enhance fire-adaptation, which would reduce the cost and risk of future wildfires.*

Managing forests as climate continues to change

Forest change in the coming decades will be dramatic with significant tree mortality due to wildfire, drought, insects and disease, and with shifts in species ranges. Approaches to forest management will likely have to change to remain effective and our ability to manage wildfire will be significantly challenged. Managing more wild and prescribed fires will help ecosystems keep pace with changing climate and reduce fire risk to communities. We will need novel ways to manage climate impacts on forests, as previous approaches will not pave the way forward in this new era. In large part, however, we will need to learn to live with the many changes that have already occurred, and will continue into the future.

Summary

Warming and wildfire have increased in the West and will continue to do so. Fuel treatments and prescribed fire can help reduce future fire risk and help ecosystems keep pace with changing climate in the near term, although they cannot meaningfully slow regional increases in wildfire. Strategically treating dry forests and forests near communities and infrastructure, including private land, can reduce negative impacts of wildfire on ecosystems, communities, and valued assets. In general, I urge policy makers to confront the challenge of helping communities and ecosystems adapt to increasing wildfire and warming in the West.

I have included two papers on the topic of wildfires in the West intended for non-experts as addendums. I look forward to continued discussions and am available to answer any questions you may have.

Thank you,

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References

1. Rasker R (2015) Resolving the Increasing Risk from Wildfires in the American West. *Solutions* 6(2):55-62.
2. Hoover K & Bracmort K (2015) Wildfire management: Federal funding and related statistics. *Congressional Research Service* 7-5700(R43077).
3. USFS (2015) The Rising Cost of Fire Operations: Effects on the Forest Service's Non-Fire Work. *http://www.fs.fed.us/sites/default/files/2015-Fire-Budget-Report.pdf*.
4. Association for Fire Ecology (2015) Reduce wildfire risks or we'll continue to pay more for fire disasters. http://fireecology.org/Resources/Documents/Reduce-WIldfire-Risk-16-April-2015-Final-Print.pdf.
5. Westerling AL (2016) Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. *Phil.Trans, of the Royal Society of London B: Biological Sciences* 371(1696).
6. Tebaldi C, Adams-Smith D, & Heller N (2012) The heat is on: US temperature trends. Climate Central, Princeton, NJ. 22pp. http://www.climatecentral.org/wgts/heat-is-on/HeatIsOnReport.pdf.
7. Abatzoglou JT & Kolden CA (2013) Relationships between climate and macroscale area burned in the western United States. *Intl. J. of Wildl. Fire* 22(7):1003-1020.
8. NOAA (2017) Contiguous U.S. Average Temperature Rankings. https://www.ncdc.noaa.gov/temp-and-precip/climatological-rankings/.
9. Center NFI (2016) Wildland fires and acres (1960-2016). https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html.
10. Picotte JJ, Peterson B, Meier G, & Howard SM (2016) 1984–2010 trends in fire burn severity and area for the conterminous US. *Intl. J. of Wildl. Fire* 25(4):413-420.
11. Finco M, *et al.* (2012) Monitoring trends and burn severity: monitoring wildfire activity for the past quarter century using Landsat data. *GTR-NRS-P-105. USDA Forest Service, 222-228.*
12. Bentz B, *et al.* (2010) Climate Change and Bark Beetles of the Western United States and Canada: Direct and Indirect Effects. *BioScience* 60(8):602-613.
13. Six D, Biber E, & Long E (2014) Management for mountain pine beetle outbreak suppression: does relevant science support current policy? *Forests* 14(5):1.
14. Fyfe J, *et al.* (2017) Large near-term projected snowpack loss over the western United States. *Nature Communications* 8(14996):doi: 10.1038/ncomms14996.

15. Melillo J, Richmond T, & GW Yohe eds (2014) *Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2, pg 29. http://s3.amazonaws.com/nca2014/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1*).
16. Yue X, *et al.* (2015) Impact of 2050 climate change on N. American wildfire: consequences for ozone air quality. *Atmos. Chem. and Physics* 15(17):10033-10055.
17. Barbero R, Abatzoglou JT, Steel EA, & Larkin NK (2014) Modeling very large-fire occurrences over the continental United States from weather and climate forcing. *Environmental Research Letters* 9(124009):doi:10.1088/1748-9326/1089/1012/124009.
18. Schoennagel T, *et al.* (2017) Adapt to increasing wildfire in western North American forests as climate changes. . *Proceedings of the National Academy of Sciences* Early Edition:www.pnas.org/cgi/doi/10.1073/pnas.1617464114.
19. JTAbatzoglou & Kolden C (2013) Relationships between climate and macroscale area burned in the western United States. *International Journal of Wildland Fire* 22:1003–1020. http://dx.doi.org/1010.1071/WF13019.
20. Wildland_Fire_Leadership_Council (2017) Hazardous Fuels Reduction and Landscape Restoration Accomplishments Fiscal Years (FY) 2001-2016.:https://www.forestsandrangelands.gov/resources/reports/documents/2016/HFR_DOI_FS_Accomplishments2001-2016.pdf.
21. Barnett K, Parks SA, Miller C, & Naughton HT (2016) Beyond fuel treatment effectiveness: Characterizing Interactions between fire and treatments in the US. *Forests* 7(237):1-12.
22. Schoennagel T, Veblen TT, & Romme WH (2004) The interaction of fire, fuels, and climate across rocky mountain forests. *Bioscience* 54(7):661-676.
23. Cochrane M, *et al.* (2013) Fuel Treatment Effectiveness in the United States. *Joint Fire Science Program Final Project Report for (JFSP Project # 06-3-3-11)*:http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1088&context=jfspresearch.
24. Botts H, Jeffery T, McCabe S, Stueck B, & Suhr L (2015) Wildfire hazard risk report. *Corelogic*.
25. Quadrennial Fire Review (2015) 2014 Quadrennial Fire Review: Final Report. (USDA Forest Service Fire & Aviation Management and Department of the Interior Office of Wildland Fire, Washington DC).
26. Schoennagel T, Nelson CR, Theobald DM, Carnwath GC, & Chapman TB (2009) Implementation of National Fire Plan treatments near the wildland–urban interface in the western United States. *PNAS* 106(26):10706-10711.
27. American_Forest_Foundation (2016) Western Water Threatened by Wildfire: It's not just a public lands issue.https://www.forestfoundation.org/stuff/contentmgr/files/1/3d98bbe91b03a90bdf94c726534d726438b726530ab/misc/final_fire_report.pdf.
28. USDA (2006) Audit Report: Forest Service Large Fire Suppression Costs. (Office of Inspector General Western Region, USDA, Washington, DC).