

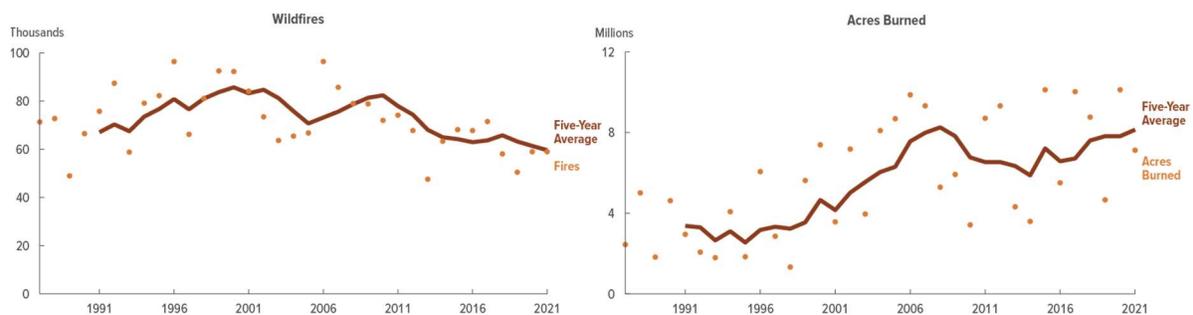
Issue Summary:

Perhaps no forestry-related topic has elicited more attention in recent years than wildfire. Public discourse has focused on the likely future frequency of fire, the economic, environmental, and social costs of fire, and on strategies for mitigating against the threat that it poses to social and environmental wellbeing. The events of recent years have only served to underscore the urgency of the issue, as the state of Oregon experienced in 2020 one of the most destructive wildfire seasons in the state's recent history. In 2020 alone, over 1 million acres of forestland burned, and five "megafires" of over 100,000 acres each dotted the landscape.¹ These fires devastated several communities, causing the evacuation of over 50,000 people, directly leading to the destruction of over 6,000 homes and a number of small businesses, and producing hazardous air pollution across the state's most populous areas.² In addition, billions of dollars of merchantable timber were destroyed in the infernos.³ Even if 2020 proves to be something of an anomalous outlier, it is clear that, at present, the risk of catastrophic loss from wildfire is more pronounced across the state than it has been in decades.

As those whose livelihood relies on the health and stability of the state's forest resources – both public and private – Oregon's private forestland owners and forest product manufacturers are acutely aware of the importance of both correctly diagnosing the scope and nature of the problem and of promoting solutions that have the greatest likelihood of producing sustained success in addressing the underlying problems. When failure of a policy means the generational destruction and loss of resources, such failure is not an option.

Are wildfires actually getting worse, or is this just an example of amplified media attention and confirmation bias?

Wildfire is a natural phenomenon that has historically occurred and will always occur on the landscape, with or without human intervention. That said, the intensity, duration and frequency of fires has varied over time, and though the annual *number* of wildfires in the United States shows no upward trend, it appears that there is a trend toward a higher incidence of large, stand replacing fires⁴ as illustrated in the following graphs.⁵



¹ Rasmussen et al., *2020 Labor Day Fires*, Oregon Forest Resources Institute, Sept. 2021. Available at, <https://tinyurl.com/yeynx32u>.

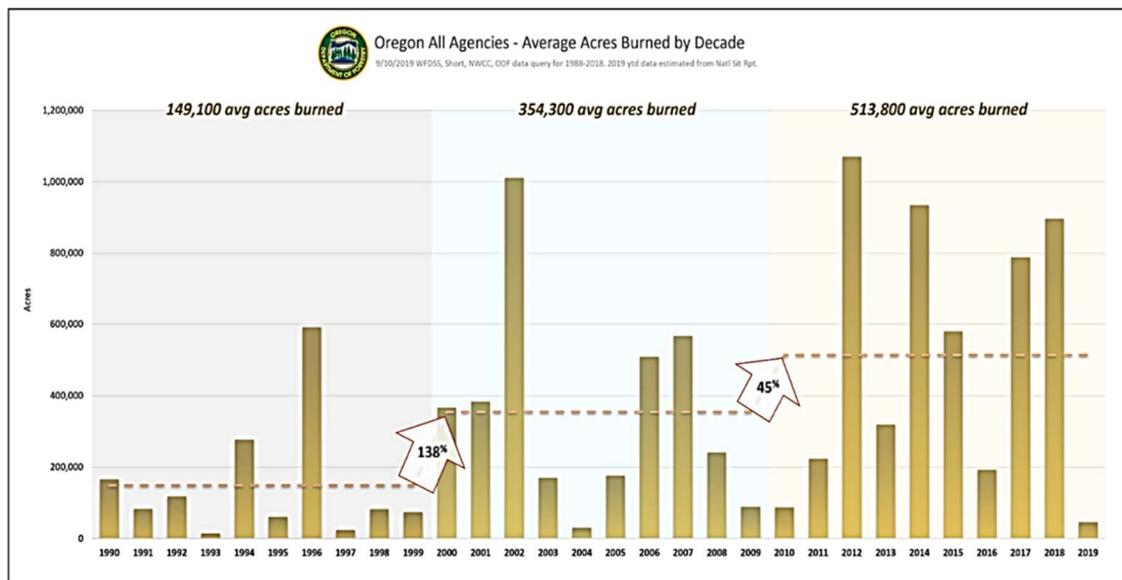
² *Id.*

³ *Id.*

⁴ See, Prichard et al. *Adapting western North American forests to climate change and wildfires: 10 common questions*. J. of Ecological Applications, 31(8), 2021.

⁵ Data source: National Interagency Fire Center, "Total Wildland Fires and Acres," www.nifc.gov/fire-information/statistics/wildfires. See www.cbo.gov/publication/57970#data.

As seen in the graph, below, the story is largely the same in Oregon, where the ten-year average of the total number of *acres burned* each year has increased over three-fold in the past three decades.⁶



What’s causing this? Is it primarily driven by climate change? Forest management decisions? Something else?

Large, stand-replacing fires, though exacerbated by a warming climate and a buildup of surface, ladder, and canopy fuels from decades of non-management of public forests and active fire suppression⁷ are not a purely modern phenomena, especially in Oregon’s denser western forests. In fact, a statewide survey by the United States Geological Survey from 1902 revealed that, at that time, over one third of the forested area in Oregon west of the Cascade ridge containing merchantable timber was completely burned.⁸ The report found that stand-replacing fires – though less frequent – were far more prevalent in the west Cascades and the coast range than in the drier, sparser forests in southwest and eastern Oregon, which saw more frequent fires of low to moderate severity.⁹ In fact, it was the regular incidence of such large, stand-replacing fires in the state’s western forests that enabled the state’s sunlight-loving

⁶ See, *Governor’s Council on Wildfire Response*, November 2019: Report and Recommendations, p. 5. Available at: <https://www.oregon.gov/osp/Docs/GovWildfireCouncilRpt-FinalRecs.pdf>.

⁷ Prichard et al. 2021.

⁸ Henry Gannet, “*The Forests of Oregon*,” U.S. Geological Survey, U.S. Dep’t of the Interior, Professional Paper No. 4, Series H, Forestry, 1, 1902. Available at: <https://pubs.usgs.gov/pp/0004/report.pdf>. (A map visualizing the findings of the report is available at: <https://pubs.usgs.gov/pp/0004/plate-1.pdf>).

⁹ *Id.* Note, however, that this does not mean that east-side old growth pine is immune to stand-replacing fires. The 2003 Davis Fire, which burned over 20,000 acres of forested landscape mostly within the Davis Late Successional Reserve boundary resulted in complete tree mortality in nearly 75% of the burned acres. See, “This Late-Successional Reserve is designed to maintain a functional, interacting, late-successional and old-growth forest ecosystem,” Northwest Forest Plan, ROD C-11, Davis LSR Assessment Team, 2007. Available at, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd501611.pdf.

state tree, Douglas-fir (*Pseudotsuga menziesii*) to become dominant in a zone that typically favors shade tolerant species such as the Western Hemlock.¹⁰

The state has avoided this cycle of periodic stand-replacing fire over the past century primarily through wildfire suppression and fuel load reduction via active forest management.

However, in the late 1980s and early 1990s, in response to concerns about impacts of harvests to threatened and endangered species, federal forests and many state forests largely ceased to be actively managed, with harvests on federal forestland in Oregon declining by 86 percent between 1985 and 1995 (see graph, below).¹¹

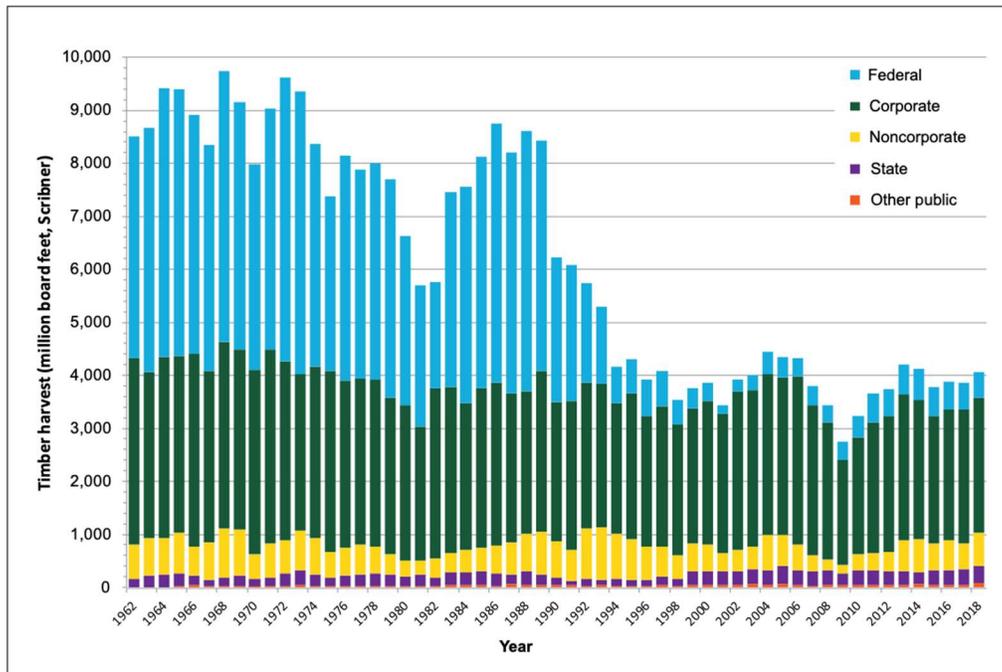


Figure 3—Oregon’s timber harvest by ownership, 1962–2018. Source: ODF 2019.

When paired with a fire policy aimed at preventing the regular occurrence of low or moderate severity fires, this resulted in the buildup of fuels in public forests.¹² Comparing the timing of the decline of harvest from federal forests to the timing of the increase in acres burned each year, an apparent trend begins to appear. At present, federal forests experience a mortality rate that is far greater than that on

¹⁰ See, “Natural Vegetation of Oregon and Washington,” Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station, 1973, p. 70-71 (noting that the seral forests in the *Tsuga heterophylla* Zone in western Washington, Oregon, and British Columbia has come to be dominated by *Pseudotsuga menziesii* as a result of stand-clearing fires and logging). Available at: https://www.fs.usda.gov/pnw/pubs/pnw_gtr008.pdf. This undercuts the argument that old growth Douglas Fir is fire resilient and presents less fire risk, as the very existence of Douglas Fir in the wet forests to the west of the cascade crest depend on stand-replacing fires.

¹¹ See, “History of Timber Taxes,” *State of Oregon Legislative Revenue Office*, Research Report No. 6-00, June 22, 2000, p. 20. Available at, <https://www.oregonlegislature.gov/lro/Documents/report%206-00.pdf>.

¹² Jan W. van Wagtenonk, “The History and Evolution of Wildland Fire Use,” *Fire Ecology*, vol. 3, no. 2 (December 2007), doi.org/10.4996/fireecology.0302003.

private and state forests.¹³ This higher mortality rate translates to more dead and decaying fuel on the landscape, thereby increasing the susceptibility of those lands to fire. Layer on an additional compounding factor¹⁴ like a warming climate, and the likelihood of experiencing large, high intensity wildfire on the landscape increases substantially. Fire is nature’s way of turning over unmanaged forests.

It is also undoubtedly true that, as human population increases and as infrastructure increases on the landscape to accommodate a growing population (especially high-power transmission lines), there is a commensurate increase in the risk of accidental fire starts and potentially more destructive fires.¹⁵ In view of this risk, the Governor’s Council on Wildfire Response recommended that Oregon pass legislation requiring utilities to prepare risk-based wildfire standards and procedures to mitigate against fire starts from poorly maintained or damaged transmission lines.¹⁶ The increase in fire risk presented by changing land use and the growth of population centers adjacent to the forested landscape will undoubtedly require greater vigilance and establishment of carefully-tailored mitigative measures.

Are all forests being affected to the same degree?

No. Statistics show, convincingly, that federal lands are more susceptible to fire than state and private lands.¹⁷ According to a Congressional Budget Office report, “[o]n average, a fire on federal lands is five times the size of one on nonfederal lands.”¹⁸ This trend holds true when one considers Oregon in isolation, both in terms of the total number of acres burned each year, and the rate at which that yearly total has grown. Over the past ten years, 93 percent of the forest acres burned every year have been on public lands – even though just over half of the state’s forests fall under federal jurisdiction – and the

¹³ “Oregon Forest Facts 2021-22 Edition,” Oregon Forest Resources Institute, p. 5, *available at* https://oregonforests.org/sites/default/files/2021-01/OFRI_2021ForestFacts_WEB3.pdf.

¹⁴ If the increase in fire was due primarily to climate change, one would expect all forests to be impacted to a roughly similar degree, but this is simply not the case (as discussed in the subsequent section). Federal lands have seen a far greater increase in the size of fires than state or private lands have. This is likely largely driven by management decisions on those lands, but even on federal lands, BLM lands, which are managed similarly to Forest Service lands, but that are typically situated directly adjacent to private lands and are protected by the state Department of Forestry (ODF) generally fare far better than Forest Service lands. This demonstrates the importance of ease of access and utilization of a direct attack strategy to extinguish fires quickly.

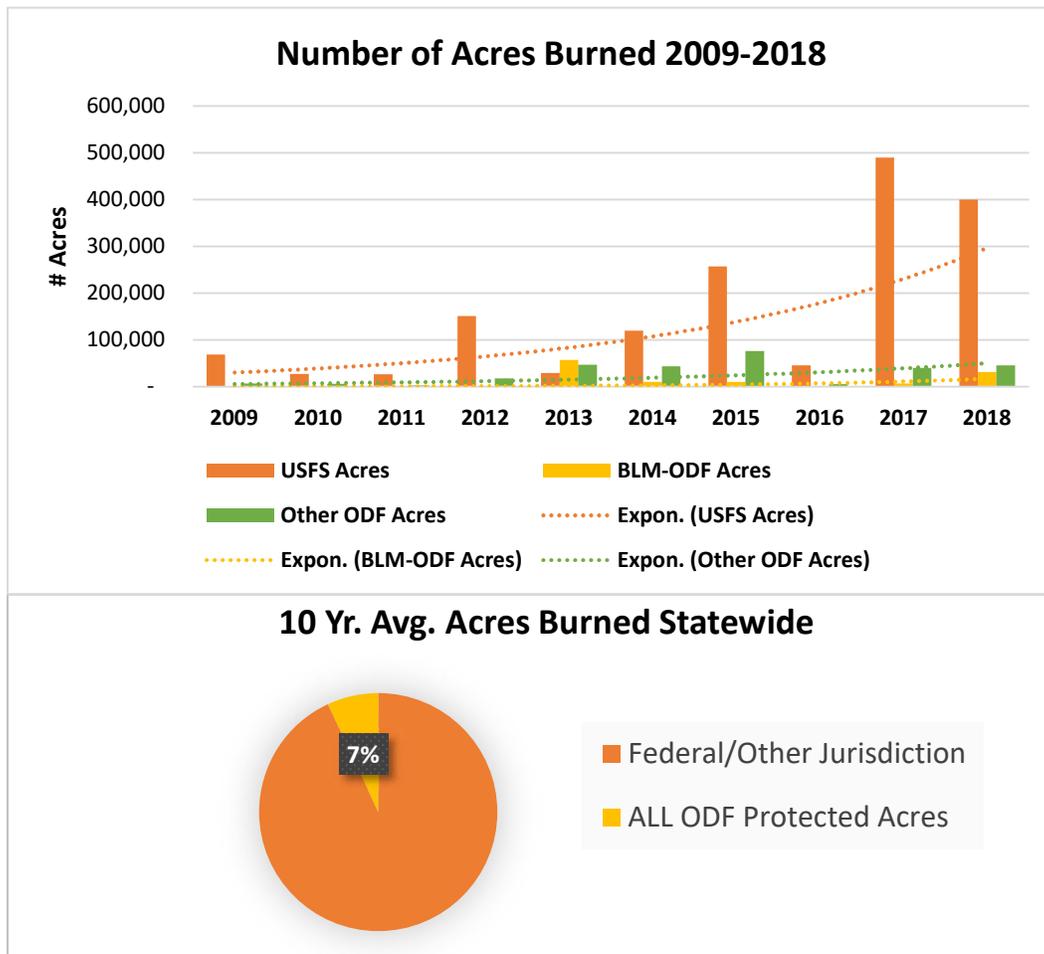
¹⁵ The report by the Governor’s Council of Wildfire Response cited, above, noted that a 2009 study of fires in Southern California found that wildfires started by transmission lines were, on average, 10x larger than other wildfires, and that, of the top 20 most destructive wildfires in California state history, 8 were power line fires. *Governor’s Council Report* at 8.

¹⁶ *Id.* at 19.

¹⁷ Starrs et al., “The impact of land ownership, firefighting, and reserve status on fire probability in California,” *Environmental Research Letters* 13 (2018), *available at* <https://iopscience.iop.org/article/10.1088/1748-9326/aaaad1> (*finding that the difference in fire probability on federal versus non-federal lands is increasing over time*).

¹⁸ “Wildfires,” *Congressional Budget Office*, June 2022, p. 3. *Available at*, www.cbo.gov/publication/57970.

rate of the year-over-year increase in acres burned on federal forestland has outpaced that on state-protected lands (including state and private lands).¹⁹



Even though the problem is most pronounced on public lands, private, working forests are susceptible to wildfire, and are directly imperiled when high-intensity²⁰ fires burn on adjacent public lands. An untimely fire can destroy an entire young stand of timber, wiping out an investment that takes decades to replace. Fires on public lands may, on average, be larger and more difficult to contain and extinguish, but they can be acutely destructive when they spill over onto private forestland.

¹⁹ Data Source: National Interagency Fire Center. “Historical year-end fire statistics by state.” Available at, <https://www.nifc.gov/fire-information/statistics>. The 2020 and 2021 fire seasons did see a dramatic increase in private acres burned (though still significantly less than what was burned on federal forestland), but it remains to be seen if those years (2020, in particular) will prove in the long run to be anomalous in that regard.

²⁰ “Intensity” speaks to how hot a fire burns, how quickly it moves, and how difficult it is to contain, whereas “severity” speaks to the ecological impacts of a fire, especially with regard to post-fire tree mortality. See, J.E. Keeley, “Fire,” *Encyclopedia of Ecology*, 2008, pp. 1557-1564. Though the terms are often confused, “severity” arguably receives more attention in the press.

Well sure, most fires occur on federal lands, but isn't that merely a function of there being more federal forestland than state and private land in Oregon?

No. Federal research definitively shows that, though the average size of wildfires on public land is significantly higher than on private forestland, the number of fire *starts* on public and private land is roughly equivalent, if not slightly lower on federal forestland.²¹ Again, this is true even though over half of the state's forestland is federally owned. The fact of the matter is that fires that start on private lands are typically easier to control, owing to a variety of factors including ease of access to fight those fires (i.e. a well-maintained system of forest roads) and the existence of a mixed-age forest mosaic on actively managed land. Further, landowners devote significant resources to making sure that any starts that occur on their lands are quickly suppressed.²² The study produced by the Governor's wildfire council highlighted Oregon's longstanding history of cooperation between "forest landowners, community members, [the Oregon Department of Forestry], and the [regional fire] associations" and its effectiveness in "detect[ing], attack[ing], and contain[ing] wildfire and minimiz[ing] damage" from it. This collaborative approach has been key to ODF meeting its goals for fire containment.²³

How does wildfire impact communities and natural resources?

As already indicated, private forest resources are directly imperiled by wildfire, however this is far from the only negative effect (or even the most prominent negative effect) of wildfire on the human population. As public lands become more susceptible to high-intensity fires and as population centers continue to expand within the wildland/urban interface (WUI), communities and homes located near the forest face ever-increasing public health and safety risks. Direct economic impacts from property damage and loss is but one piece of the costs borne by the communities directly impacted by wildfire.²⁴ And the mid- to long-term negative impacts to property values and cost-of-living make recovery for these communities a protracted and difficult prospect.²⁵ Beyond forest-adjacent communities, even communities located hundreds of miles from wildfire are subject to negative health impacts from smoke

²¹ CBO Wildfire Report, at 1.

²² It is important to note that private landowners address fire starts on their property regardless of the cause of the fire. The 10-year average indicates that only 5% of fires that start on private lands are caused by forestry-related activities.

²³ As a recent example of the magnitude of resources provided by private landowners, wildfire incident data compiled by the state demonstrates that during the destructive 2020 Labor Day Fires, private landowners provided 658 personnel and 357 pieces of equipment to attack the various fires that broke out across the state. See, https://ftp.wildfire.gov/public/incident_specific_data/pacific_nw/Z_2020_HISTORIC/2020_Incidents_Oregon/.

²⁴ Wang, et al., "Economic Footprint of California Wildfires in 2018," *Nature Sustainability*, vol. 4 (2021), available at, doi.org/10.1038/s41893-020-00646-7 (finding that socio-economic impacts of wildfire in affected communities included, destroyed and damaged capital, health costs related to smoke exposure, and indirect losses from economic disruption and cascading impacts on regional and national supply chains).

²⁵ See, John Loomis, "Do Nearby Forest Fires Cause a Reduction in Residential Property Values?", *Journal of Forest Economics*, vol. 10, no. 5, Nov. 2004, available at, doi.org/10.1016/j.jfe.2004.08.001; Julie M. Mueller, et al., "Do Repeated Wildfires Change Homebuyers' Demand for Homes in High-Risk Areas?", *Proceedings of the Third International Symposium on Fire Economics, Planning, and Policy: Common Problems and Approaches*, General Technical Report PSW-GTR-227, Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station, November 2009, available at, doi.org/10.2737/PSW-GTR-227; Selma Hepp, *The Impact of Wildfires on Rent and Home Prices*, CoreLogic, Sept. 2021, available at, <https://tinyurl.com/2cdkmuut>.

exposure,²⁶ and post-fire impacts on watersheds can imperil the community drinking water resources far downstream of fire-impacted landscapes.²⁷

In addition to negative impacts on communities, the types of wildfires experienced today can have a profoundly negative effect on natural ecosystems. Aquatic ecosystems can be adversely impacted by post-fire increases in flooding, sedimentation, and incidence of harmful algal blooms.²⁸ High-intensity wildfires can also alter the productivity of forest soils, prolonging the timeline for post-fire regrowth and restoration, and can change the vegetative makeup of the forest²⁹ which can also impact the suitability of affected areas as wildlife habitat.

Finally, emissions from wildfires “account for an increasing share of net national carbon dioxide emissions” and high-severity wildfires produce higher net emissions due to more of the carbon stored in the forest being released in the fire and through post-fire decomposition.³⁰

Should efforts focus primarily on the WUI and on hardening homes in forest-adjacent communities?

No. Home hardening techniques will almost certainly reduce direct losses from wildfire in the form of property damage or destruction and should form part of any suite of solutions intended to mitigate wildfire impacts. That said, home hardening alone is not a cure-all, and even the most effective home hardening technologies cannot guarantee the survival of property or the safety of human life.³¹ Even if a hardened home survives, it may be significantly damaged, and the property owner faces the very real prospect that fire exposure will lead to a decrease in property value. Further, targeting the WUI alone for treatments (whether via mechanical thinning, prescribed fire, or both) is often impractical, and is too narrow in scope to address the watershed-scale problem posed by increasingly fire-prone forests.³² There is growing evidence demonstrating that strategic fuel treatments across larger spatial extents is both effective and necessary for indirectly reducing the risk of wildfire to communities within the WUI.³³ Further, as described above, home hardening does nothing to mitigate against the harmful impacts from wildfire smoke, both for communities located in close proximity to the forest and in distant population centers.

If fire is a naturally occurring phenomenon, wouldn't it be better to just let nature run its course?

“Letting wildfires burn” is a misguided attempt to return to a “natural” fire regime and is not a viable policy solution. As a preliminary matter, historical records demonstrate the idealistically conceived “natural” forest is almost certainly illusory. Even unmanaged forests change over time in response to environmental pressures such as disease, stochastic disturbance (e.g. wind, ice, fire, etc.), or a changing climate. Further, in the case of Oregon’s public forests, after decades of fuel buildup on federal lands

²⁶ See, Wang, et al.; CBO Wildfire Report, at 12.

²⁷ Bladon, et al., “Wildfire and the Future of Water Supply,” *Env. Sci. Technology*, 2014, pp. 8936-8943, available at, <https://doi.org/10.1021/es500130g>.

²⁸ *Id.*

²⁹ CBO Wildfire Report, at 12.

³⁰ *Id.* at 13.

³¹ Bayless, Patrick W. and Boomhower, Judson, “Mandated vs. Voluntary Adaptation to Natural Disasters: The Case of U.S. Wildfires,” *National Bureau of Economic Research, Working Paper Series 29621* (2021) (*finding that modern, hardened homes are 40% more likely to survive a major wildfire than non-hardened homes*).

³² Prichard et al., at 14.

³³ *Id.*

due to active suppression and a lack of active management, these forests no longer exist in the condition that they did a century ago.³⁴ These landscapes must be returned to a more resilient fire regime, and allowing them to burn unchecked during summer months without first removing dense surface and ladder fuels risks subjecting the forest to large, high intensity fire resulting in total mortality.³⁵ Further, as described, above, fire has profound impacts on individuals who live in or near the forest, as well as on the public at-large through downstream effects on habitat, air and water quality, and accessibility. Letting fires burn during a time of year when weather and moisture conditions make it nearly impossible to control is simply not a tenable modern-day strategy, and though there are risks inherent to active fire suppression (not only to those on the front lines of wildfire fighting), the tradeoffs make this, on the whole, the most viable approach in many situations. This is not to say that in certain instances, given the right conditions (including weather, fuel moisture content, geography, etc) managing fires may not be preferable to active fire suppression, but the number of contingencies that must work together to make this a viable strategy means that it will only work in a small number of circumstances.

There is abundant scientific evidence that mechanical thinning combined with prescribed burning is an effective strategy for reducing fire risk, and that reducing fuel loads also reduces the incidence of large, high-intensity and high-severity fires during hot, dry summer months that fill the air with smoke.³⁶

There is also strong evidence for the positive impact of post-fire restoration via salvage logging and removal of burned debris to reduce fuels that could facilitate a reburn. Studies have found that post-fire logging reduces woody fuels for up to four decades³⁷ and that, in the absence of removal of burned, woody debris, a subsequent fire within a previously burned area is more likely to result in repeat, high severity fire.³⁸ Though there is room for discussion regarding how best to manage burned forests, there is abundant evidence that direct treatment and management can result in better ecological outcomes and more resilient forests.³⁹

³⁴ *Id.* at 15.

³⁵ *Id.*

³⁶ See, Tubbesing et al., "Strategically placed landscape fuel treatments decrease fire severity and promote recovery in the northern Sierra Nevada," *Forest Ecology and Management*, Vol. 436 (2019), available at, <https://doi.org/10.1016/j.foreco.2019.01.010>; Sanchez et al., "Do Fuel Treatments in U.S. National Forests Reduce Wildfire Suppression Costs and Property Damage?," *Journal of Natural Resources Policy Research*, Vol. 9 (2019), available at <https://doi.org/10.5325/naturesopolirese.9.1.0042>; Graham et al., "Fuel treatments, fire suppression, and their interaction with wildfire and its impacts: the Warm Lake experience during the Cascade Complex of wildfires in central Idaho," *U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station*, Gen. Tech. Rep. (2007), available at <https://doi.org/10.2737/RMRS-GTR-229>; Prichard et al, *supra*.

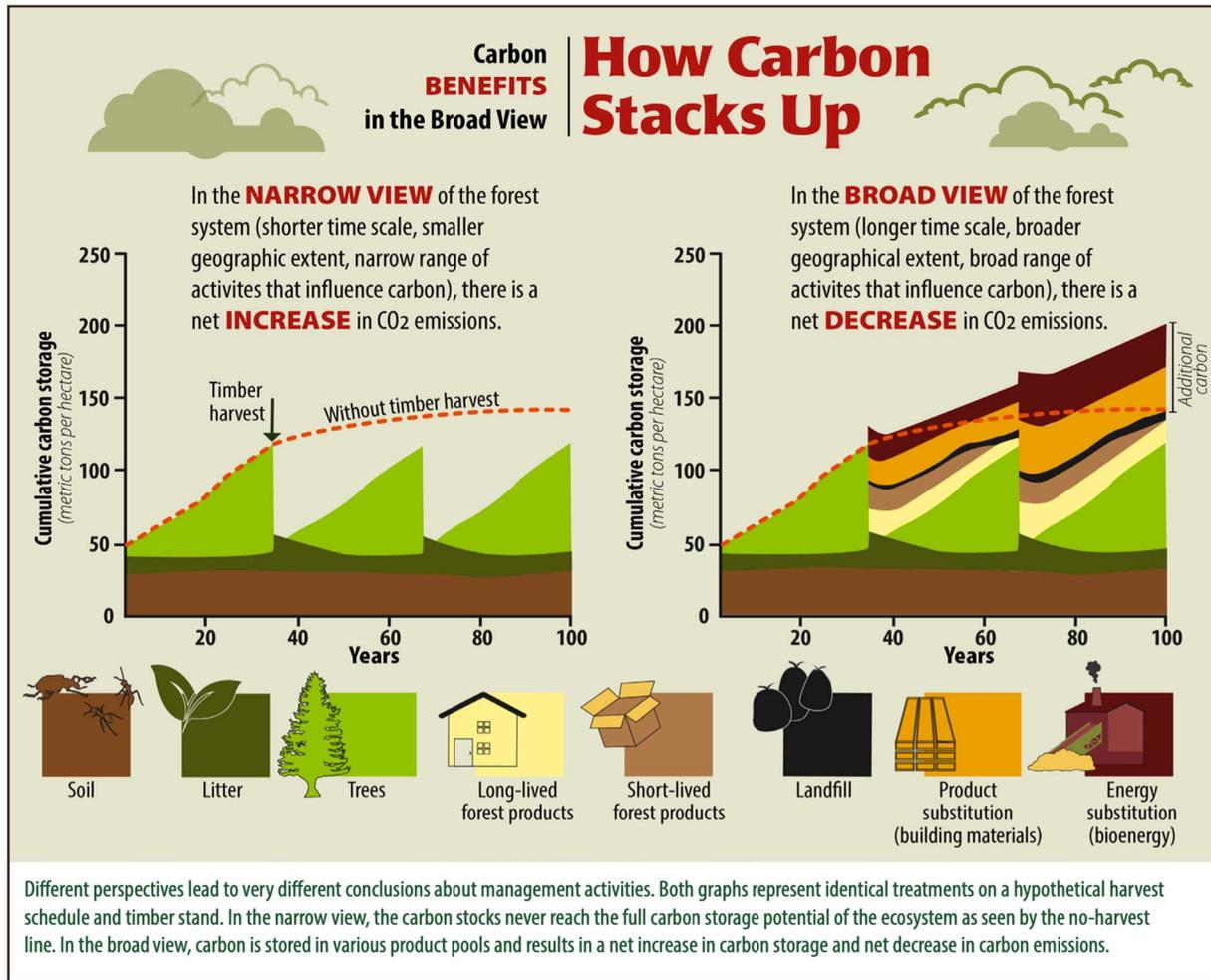
³⁷ Peterson et al., "Post-fire logging reduces surface woody fuels up to four decades following wildfire," *Forest Ecology and Management*, Vol 335 (2015), available at <https://bit.ly/3stCFIs>.

³⁸ See, Peterson and Harrod, "Post-fire Logging: An Effective Tool for Managing Future Fuels in Coniferous Inland Northwest Forests," U.S. Joint Fire Science Program Briefs, 2011, available at <https://bit.ly/2Qu12Im>.

³⁹ See also, Heil and Burkle, "Recent post-wildfire salvage logging benefits local and landscape floral and bee communities," *Forest Ecology and Management*, Vol. 424 (2018) (*finding that* post-fire logging produces near-term benefits for landscape flora and bee communities); Sample, "Potential for Additional Carbon Sequestration through Regeneration of Nonstocked Forest Land in the United States," *Journal of Forestry*, Vol. 155, Issue 4, (2017) (*finding that* regenerative reforestation following fire can increase carbon stocks and decrease CO2 emissions and "expand other ecosystem goods and services, especially watershed protection, wildlife habitat, wood production, and increased economic opportunity in rural communities").

I've heard that harvesting trees is less climate-friendly than just letting forests grow and eventually burn. Is that true?

No. Numerous studies have demonstrated that managing forests can actually enhance their natural carbon sequestration capabilities⁴⁰ and that mechanical harvests resulting in a sustainable flow of wood fiber for use in place of alternative materials that require more carbon-intensive inputs (such as concrete and steel) results in a net increase in sequestration compared to an unmanaged scenario.^{41 42}



Those who insist that leaving forests alone is the most climate-friendly approach likely either fail to consider the effects of such factors as substitution (i.e. substituting low carbon-intensive materials for

⁴⁰ See, e.g., Kauppi, et al., "Managing existing forests can mitigate climate change," *Forest Ecology and Management*, 513 (2022), (finding that significantly increasing harvests resulted in an increase in carbon sequestration and enhanced the forest as a carbon sink); Gunderson et al., "Old-growth forest carbon sinks overestimated," *Nature*, 591 (2021), (finding that net ecosystem productivity and net primary production are lower for unmanaged forests than for managed forests).

⁴¹ "NCASI Review of Carbon Implications of Proforestation," *National Council for Air and Stream Improvement*, Dec. 2020.

⁴² Graphic copied from United States Department of Agriculture Office of Sustainability & Climate *Timber Harvest & Carbon* report, available at <https://www.fs.usda.gov/sites/default/files/TimberHarvest-Carbon-3pg-v3.pdf>.

higher carbon-intensive materials) and leakage (i.e. the amount of deferred harvest that will simply be displaced to another geographic jurisdiction) on carbon accounting⁴³ or treat forest carbon as permanent.

The idea that forests will continue to store carbon indefinitely is – incontrovertibly – simply a myth. Eventually forests will burn (or experience mortality from other causes such as insects, disease, wind damage, etc.). When this happens, the carbon that was stored in the forest will be returned to the atmosphere. In the historic Oregon Labor Day fires in 2020, for example, the amount of carbon that was emitted surpassed total annual emissions by both the state’s transportation sector and energy sector.⁴⁴ By managing forests and removing fuels, we can prolong the lifecycle of much of the carbon sequestered by the forest if removed timber is converted into long-lived wood products.⁴⁵ This approach has the added advantage of putting forest carbon to a beneficial use as opposed to waiting for it to simply be emitted in the form of wildfire smoke or from decomposing burned material.

So are you saying that we should manage federal and state forestland exactly like we manage private timberland?

No. Forests can be managed for different outcomes to meet different objectives and goals, and a practice that is appropriate for a privately-owned working forest may not be appropriate for a public forest that is being managed as a reserve or for recreational use. The aim is not to convert every forest in the United States to an intensively managed working forest, but to restore public forest health and, in doing so, to make those forests more fire resilient and less of a liability to communities, Oregon citizens, and neighboring landowners.

There is no perfect solution to wildfire. It will always be part of the landscape, and every strategy employed to mitigate its effects will have drawbacks and vulnerabilities. This is especially true in a forest environment that is increasingly fire-prone, and one in which more people live in close proximity to these fire-prone areas. This does not mean, however, that the solution is to give up and learn to live with it. Practices can be implemented to mitigate against the increasing danger of fire (such as home hardening, investment in infrastructure, and active suppression) and to mimic fire’s effects while avoiding the total loss that would occur were those forests to be subjected to wildfire (such as thinning, fuels reduction, and prescribed burning). These latter strategies especially help to ensure that the forested landscape is more resilient to fire when the inevitable happens.⁴⁶ A proactive, management-focused strategy is a win for local communities, for adjacent landowners, and for Oregon’s forests.

⁴³ See, e.g., Law et al., “Land use strategies to mitigate climate change in carbon dense temperate forests,” *Proceedings of the National Academy of Sciences of the United States of America* 115:3663–3668 (2018), available at, <https://doi.org/10.1073/pnas.1720064115>.

⁴⁴ Copernicus Atmosphere Monitoring Service/European Centre for Medium-Range Weather Forecasts; *Oregon Global Warming Commission*.

⁴⁵ Oneil and Lippke, “Integrating Products, Emission Offsets, and Wildfire Into Carbon Assessments of Inland Northwest Forests,” *Consortium for Research on Renewable Industrial Materials* (2009), available at, <https://tinyurl.com/3n92pvhu> (finding that, in light of the risk of wildfire and mortality from disease and pests, removing merchantable timber and turning it into long-lived products helps to ensure that forests “collectively remain a growing carbon sink rather than a carbon source”).

⁴⁶ A recent example of the success of this approach, in practice, can be seen from the 2021 Bootleg Fire, which burned over 400,000 acres in southern Oregon. Of those acres that were impacted by the fire, 15,000 were on The

Nature Conservancy's Sycan Marsh Preserve, which had been subjected to a number of fuels reduction treatments for two decades. The areas that had been subject to treatment saw demonstrably less mortality and forest loss than even directly adjacent untreated acres. For more information on TNC's project and the impact of the Bootleg Fire, see <https://www.nature.org/en-us/about-us/where-we-work/united-states/oregon/stories-in-oregon/climate-change-wildfire-recovery/>.