**350 Eugene ● Cascadia Wildlands ● Center for Biological Diversity ●
Conservation Northwest ● Earthjustice ● Environment America ● Environment Oregon ●
Gallatin Wildlife Association ● High Country Conservation Advocates ● KS Wild ●
The Larch Company ● Natural Resources Defense Council ● New Mexico Wild ●
Old-Growth Forest Network ● Oregon Wild ● RESTORE: The North Woods ●
Rocky Mountain Wild ● Sierra Club ● Standing Trees ● WildEarth Guardians ●
Yaak Valley Forest Council**

July 5, 2023

U.S. Department of the Interior
Bureau of Land Management
1849 C St., NW
Washington, DC 20240

Submitted via regulations.gov

Re: Bureau of Land Management's "Conservation and Landscape Health" Proposal

The twenty-one undersigned organizations appreciate the opportunity to provide comments on the "Conservation and Landscape Health" proposal.[1] In the proposal, the Bureau of Land Management ("BLM," "Bureau," or "agency") takes an important step toward managing public lands in the national interest in accordance with the principles of multiple use and sustained yield. In particular, the Bureau's clarification that "conservation" is a use on par with other uses under the Federal Land Policy and Management Act ("FLPMA") is clearly mandated by the statute and will help to ensure that BLM considers all relevant factors in its decision-making. Historically and through the present day, conservation has too often been treated as subsidiary to other uses, with devastating consequences for our national interest and natural resources. We applaud BLM for now recognizing and working to advance the vital role of conservation in the statutory framework.

As BLM refines its consideration of conservation, one scarce and valuable resource demands near-term protection: mature and old-growth ("MOG") forests and trees. These forests and trees are critical tools in the fight against climate change, as they store and continue to sequester vast quantities of carbon. They also provide irreplaceable habitat to support biodiversity, clean drinking water for communities, and unique recreational opportunities.

Mature and old-growth forests were once prevalent across the nation's landscapes, but centuries of intensive logging has left them severely diminished, and now only a fraction of these climate-critical forests remain. Unfortunately, rather than robustly protect the key MOG strongholds found on federal lands, federal agencies including BLM continue to sell it, imperiling carbon stores and ecological communities that have developed over many decades or even centuries.[2]

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[1] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583 (Apr. 3, 2023) (proposed rule).

[2] *See* Climate Forests Campaign. *Worth More Standing: 10 Climate-Saving Forests Threatened by Federal Logging*. (2022). https://www.climate-forests.org/_files/ugd/73639b_03bdeb627485485392ac3aaf6569f609.pdf; Climate

While MOG on BLM lands faces a variety of threats, logging is an ongoing, significant threat that the Bureau directly controls and has the power to halt.

In order to give effect to the principles in the proposed rule and manage public lands in the national interest, BLM must move swiftly to issue a durable, binding rule that substantively protects mature and old-growth forests and trees on BLM lands from logging. Such a rule will be an important pillar in our nation's response to the climate and biodiversity crises and help complete the Bureau's broader conservation initiatives that the current proposal embodies. It will also bolster key priorities of the Biden administration, from the directive to conserve mature and old-growth forests in Executive Order 14072[3] to reinforcing the nation's international leadership on climate change. Because MOG exists—and provides benefits—across the nation, the rule must be national in scope and include all BLM forests; adequate protections cannot realistically be achieved through individualized, site-specific determinations. MOG forests are fire-resistant, and the rule can be crafted to allow for necessary measures to address wildfire.

A rule to protect MOG from logging is essential if BLM is to meet the objectives that the proposal articulates. Of the relatively small amount of MOG remaining nationwide, a disproportionate share is found on federal lands,[4] giving federal agencies an important role in protecting it. These forests and trees constitute a crucial subset of BLM lands, and the conservation "use" of such lands directly supports the Bureau's goal to "maintain functioning and productive ecosystems and work to ensure their resilience . . . through protection, restoration, or improvement of essential ecological structures and functions."[5] Logging is the one threat to MOG that BLM can directly control. With the climate crisis fully upon us, we simply cannot afford to lose these carbon-critical forests. Logging mature and old-growth forests and trees is flatly incompatible with any rational assessment of the conservation value of federal public lands.

These comments are submitted by the following organizations, all of which are members of the Climate Forests Campaign[6]:

- 350 Eugene
- Cascadia Wildlands
- Center for Biological Diversity
- Conservation Northwest
- Earthjustice
- Environment America

Forests Campaign. *America's Vanishing Climate Forests: How the U.S. Is Risking Global Credibility on Forest Conservation*. (2022). https://www.climate-forests.org/_files/ugd/ae2fdb_b5a2315e3e8b42498b4c269730c3955a.pdf.

[3] Exec. Order No. 14,072, 87 Fed. Reg. 24,851, 24,851 (April 22, 2022).

[4] DellaSala, D.A. et al. "Mature and old-growth forests contribute to large-scale conservation targets in the conterminous United States." *Frontiers in Forests and Global Change* (2022) 5:979528. https://doi.org/10.3389/ffgc.2022.979528.

[5] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,585 (Apr. 3, 2023) (proposed rule).

[6] Climate Forests Campaign. https://www.climate-forests.org/ (last visited June 18, 2023).

- Environment Oregon
- Gallatin Wildlife Association
- High Country Conservation Advocates
- KS Wild
- The Larch Company
- Natural Resources Defense Council
- New Mexico Wild
- Old-Growth Forest Network
- Oregon Wild
- RESTORE: The North Woods
- Rocky Mountain Wild
- Sierra Club
- Standing Trees
- WildEarth Guardians
- Yaak Valley Forest Council

Table of Contents

I. BLM SHOULD PROMULGATE A RULE PROTECTING MATURE AND OLD-GROWTH FORESTS AND TREES FROM LOGGING.

The mature and old-growth forests and trees that remain on BLM lands are irreplaceable resources for addressing the climate and biodiversity crises. The benefits that they provide today result from the decades or centuries over which they developed complex, interdependent ecosystems. These trees and forests store and continue to sequester enormous quantities of carbon, significantly reducing atmospheric concentrations of greenhouse gases ("GHGs"). Many animal and plant species—including vulnerable species—are dependent upon MOG for habitat. MOG forests and trees are resilient to changing conditions, making them valuable partners in staving off some of the worst impacts of climate change, and among forest age classes, they stand out for being fire-resistant.

Despite their many benefits, mature and old-growth forests and trees continue to be logged on BLM lands. This section highlights some of the many benefits that MOG forests and trees provide, describes the ongoing threat of MOG logging on BLM lands, and lays out essential elements of a durable rule to protect MOG as a component of the Bureau's conservation efforts.

A. MOG Provides Critical Climate, Biodiversity, and Other Benefits and Is Irreplaceable on Any Relevant Timescale.

i. MOG forests and trees are carbon storage and sequestration champions.

Carbon storage in the live wood pool

As a tree ages and grows larger, research indicates that it will continue to absorb carbon at an increasing rate.[7] As it develops, a tree's total leaf area increases, which means more light can be intercepted, which, through photosynthesis, means more atmospheric carbon is absorbed.[8] Moreover, the increase in the rate of carbon accumulation continues even as a tree's overall growth rate per unit leaf area declines.[9] Older, larger trees thus hold significantly more carbon than their younger brethren in the forest, and the older stands that these trees dominate hold a substantial and disproportionate portion of a forest's carbon.[10] A specific analysis of the carbon significance of western Oregon BLM lands can be found a few pages below.

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[7] Stephenson, N.L. et al. "Rate of tree carbon accumulation increases continuously with tree size." *Nature* (2014) 507: 90–93. https://doi.org/10.1038/nature12914.

[8] *Id.*; Xu, C.-Y. et al. "Age-related decline of stand biomass accumulation is primarily due to mortality and not to reduction in NPP associated with individual tree physiology, tree growth or stand structure in a Quercus-dominated forest." *Journal of Ecology* (2012) 100(2): 428–440. https://doi.org/10.1111/j.1365-2745.2011.01933.x; Pregitzer, K.S. and E.S. Euskirchen. "Carbon cycling and storage in world forests: biome patterns related to forest age." *Global Change Biology* (2004) 10(12): 2052–2077. https://doi.org/10.1111/j.1365-2486.2004.00866.x; Mildrexler, D.J. et al. "Large Trees Dominate Carbon Storage in Forests East of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3:594274. https://doi.org/10.3389/ffgc.2020.594274.

[9] Stephenson, N.L. et al. "Rate of tree carbon accumulation increases continuously with tree size." *Nature* (2014) 507: 90–93. https://doi.org/10.1038/nature12914.

[10] Mildrexler, D.J. et al. "Large Trees Dominate Carbon Storage in Forests East of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3:594274. https://doi.org/10.3389/ffgc.2020.594274; Lutz, J.A. et al. "Global importance of large-diameter trees." *Global*

Carbon sequestration

When looking at carbon sequestration in forest types around the U.S., a critical value is the culmination of net primary productivity ("CNPP"). CNPP—determined by reference to forest type and location—is the age at which the rate of annual carbon sequestration in a stand is at a maximum (and it is sometimes used as a proxy for the onset of maturity).[11] After this age, the rate of carbon sequestration often begins to level off or decrease slightly (although the amount of carbon stored will increase over the entire lifetime of the stand).[12] As shown in figure 1 below, CNPP age averages (not weighted by area of forest type) across BLM forested lands fall below 80 years. The CNPP age average weighted by area of each forest type for BLM lands is 87 ± 18 years. This is due to the fact that over half of BLM forested lands in the contiguous U.S. are pinyon-juniper ("P-J") woodlands. Pinyon-juniper stands have an interesting and slightly anomalous NPP trend. As shown in figure 2 below, the rate of carbon sequestration continues to increase over the lifetime of a pinyon-juniper stand. (Ponderosa pine can also exhibit this steady increase in NPP past maturity.) The data for these figures can be found in the Appendix in tables A1 and A2.

Ecology and Biogeography (2018) 27(7): 849–864. https://doi.org/10.1111/geb.12747; Brown, S.A. "Spatial distribution of biomass in forests of the eastern USA." *Forest Ecology and Management* (1999) 123(1): 81–90. https://doi.org/10.1016/S0378-1127(99)00017-1.

[11] Birdsey, R.A. et al. "Assessing carbon stocks and accumulation potential of mature forests and larger trees in U.S. federal lands." *Frontiers in Forests and Global Change* (2023) 5:1074508. https://doi.org/10.3389/ffgc.2022.1074508.

[12] He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26(3). https://doi.org/10.1029/2010GB003942; Birdsey, R.A. et al. "Assessing carbon stocks and accumulation potential of mature forests and larger trees in U.S. federal lands." *Frontiers in Forests and Global Change* (2023) 5:1074508. https://doi.org/10.3389/ffgc.2022.1074508; Birdsey, R.A. et al. "Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of U.S. national forests." *U.S. Forest Service.* Gen. Tech. Report RMRS-GTR-402. Rocky Mountain Research Station, Fort Collins, CO (2019). https://doi.org/10.2737/RMRS-GTR-402.

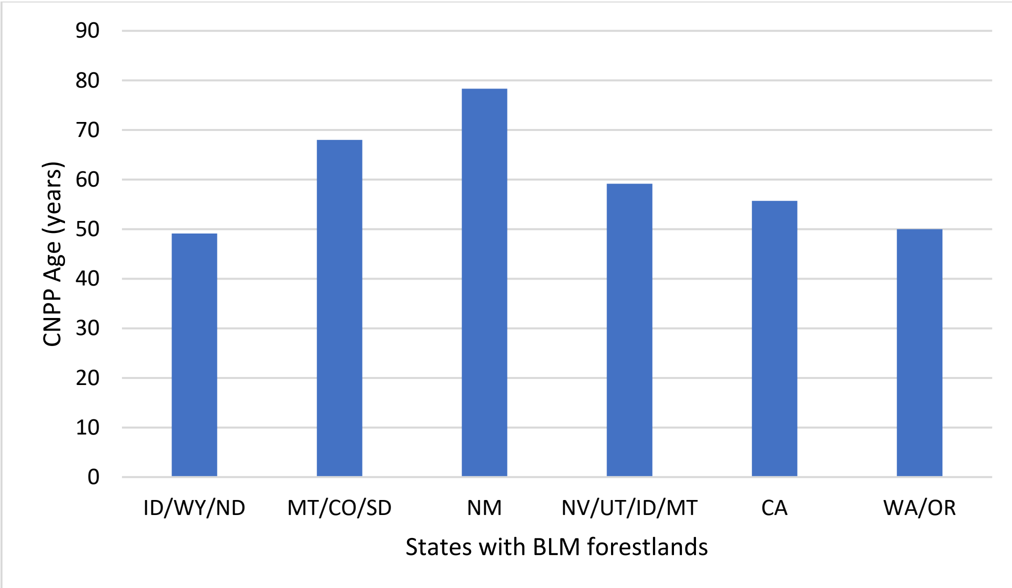

Figure 1. CNPP averages for BLM forest types (not weighted by area) in various states with BLM forestlands. Calculated based on CNPP age averages for forest types on U.S. Forest Service lands.

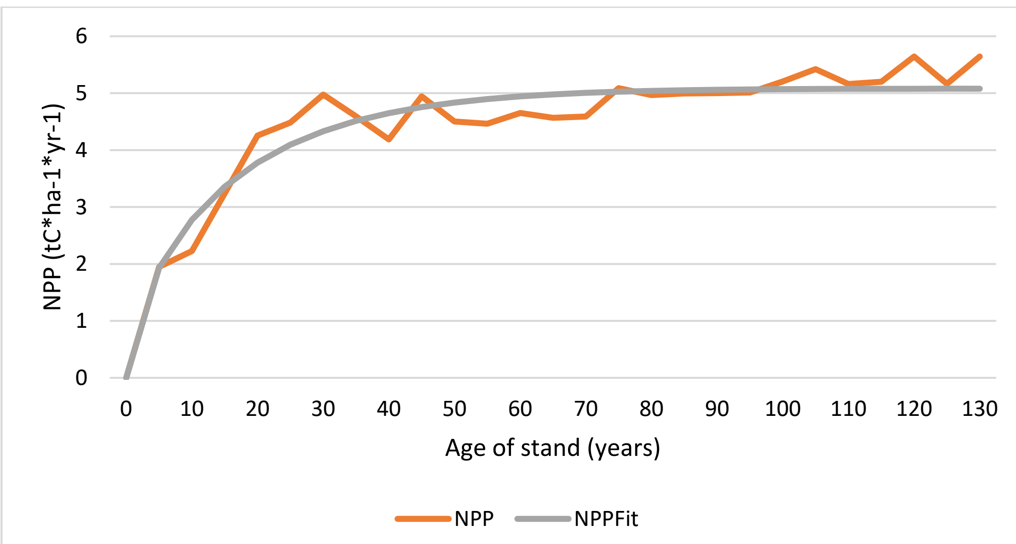

Figure 2. NPP vs. age for pinyon-juniper forest type in San Juan National Forest.[13]

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[13] He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26(3). https://doi.org/10.1029/2010GB003942; Birdsey, R.A. et al. "Assessing carbon stocks and accumulation potential of mature forests and larger trees in U.S. federal lands." *Frontiers in Forests and Global Change* (2023) 5:1074508. https://doi.org/10.3389/ffgc.2022.1074508; Birdsey, R.A. et al. "Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of U.S. national forests." *U.S. Forest Service.* Gen. Tech. Report RMRS-GTR-402. Rocky Mountain Research Station, Fort Collins, CO (2019). https://doi.org/10.2737/RMRS-GTR-402.

Carbon storage as forests age

Critically, once CNPP has been achieved, the rate of carbon sequestration does not rapidly collapse. Instead, stands often settle into significantly high annual rates of sequestration while they continue to accumulate carbon stocks. In some stands, the rate of sequestration will trend toward an equilibrium state where carbon dioxide sequestered via photosynthesis equals carbon dioxide emitted through respiration.[14] In others, the rate of sequestration will remain relatively constant, with only gradual deceleration.[15] And still others, such as pinyon-juniper forests, appear to avoid a decline in sequestration altogether and, instead, continually, if gradually, increase carbon accumulation rates over the course of centuries.[16] This behavior is demonstrated in figure 2. All told, as a general matter, the rate of carbon accumulation remains robust well into a stand's post-peak development.[17]

The carbon accumulated by trees throughout their lives will persist as wood through the end of the tree's life and beyond. Once an older tree dies from old age or natural disturbance, the carbon contained in its wood does not disappear into the atmosphere. Instead, the tree—and the lion's share of the carbon it holds—is retained in the forest as a snag (a standing dead tree) or as coarse woody debris ("CWD," a fallen dead tree) slowly decomposing over decades to centuries. This remains true even in scenarios where older, larger trees are affected by wildfire.[18] For example, research on post-fire decomposition rates in the nearly half-million acre Biscuit Fire in southwest Oregon reported that 85% of the carbon remained 10 years after the fire.[19] Additionally, field measurements in two of California's largest, most severe forest fires, the Rim and Creek fires in the Sierra Nevada, indicated that approximately 99% of the carbon remained in the large trees

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[14] Hudiburg, T.W. et al. "Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage." *Ecological Applications* (2009) 19(1): 163–180. https://doi.org/10.1890/07-2006.1; Pregitzer, K.S. and E.S. Euskirchen. "Carbon cycling and storage in world forests: biome patterns related to forest age." *Global Change Biology* (2004) 10(12): 2052–2077. https://doi.org/10.1111/j.1365-2486.2004.00866.x.

[15] Gough, C.M. et al. "Disturbance, complexity, and succession of net ecosystem production in North America's temperate deciduous forests." *Ecosphere* (2016) 7(7). https://doi.org/10.1002/ecs2.1375.

[16] Birdsey, R.A. et al. "Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of U.S. national forests." *U.S. Forest Service*. Gen. Tech. Report RMRS-GTR-402. Rocky Mountain Research Station, Fort Collins, CO (2019). https://doi.org/10.2737/RMRS-GTR-402.

[17] He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26(3). https://doi.org/10.1029/2010GB003942; Law, B.E. et al. "Changes in carbon storage and fluxes in a chronosequence of ponderosa pine." *Global Change Biology* (2003) 9(4): 510–524. https://doi.org/10.1046/j.1365-2486.2003.00624.x; Keeton, W.S. et al. "Late-Successional Biomass Development in Northern Hardwood-Conifer Forests of the Northeastern United States." *Forest Science* (2011) 57(6): 489–505. https://doi.org/10.1093/forestscience/57.6.489.

[18] Campbell, J.L. et al. "Pyrogenic carbon emission from a large wildfire in Oregon, United States." *Journal of Geophysical Research* (2007) 112. https://doi.org/10.1029/2007JG000451; Meigs, G.W. et al. "Forest Fire Impacts on Carbon Uptake, Storage, and Emission: The Role of Burn Severity in the Eastern Cascades, Oregon." *Ecosystems* (2009) 12: 1246–1267. https://doi.org/10.1007/s10021-009-9285-x; Stenzel, J. E. et al. "Fixing a snag in carbon emissions estimates from wildfires." *Global Change Biology* (2019) 25(11): 3985–3994. https://doi.org/10.1111/gcb.14716; Harmon, M.E. et al. "Combustion of aboveground wood from live trees in megafires, CA, USA." *Forests* (2022) 13(3). https://doi.org/10.3390/f13030391.

[19] Campbell, J.L. et al. "Carbon emissions from decomposition of fire-killed trees following a large wildfire in Oregon, United States," *Journal of Geophysical Research: Biogeosciences* (2016) 121(3): 718–730. https://doi.org/10.1002/2015JG003165.

postfire.[20] Additionally, a study done on juniper woodlands on aeolian sands in Oregon showed there is a lower prevalence of fine fuels/ladder fuels in old-growth stands compared to newer growth[21] resulting in a reduced fire risk and more secure carbon storage.

After they die, larger, mature trees often decay more slowly than smaller, younger trees, in both snag and CWD form. Snags are an important aboveground carbon pool[22] and can take upwards of a century (or more) to decompose.[23] Their longevity is due in large part to being more isolated from the agents of decomposition that live on the forest floor (fungi, bacteria, etc.).[24] One of the primary determinants of fall rates among snags is mean annual temperature: warmer climates tend to accelerate decomposition and tree collapse.[25] That said, older, larger trees tend to last substantially longer as snags than smaller trees.[26] In the Cascade Mountains of Oregon, for example, snags of trees greater than 21 inches diameter at breast height lasted 2 to 5 times longer than smaller trees of the same species.[27]

CWD often decomposes faster than snags, but the CWD generated by older stands can still retain carbon for extended periods of time.[28] In the Pacific Northwest, for instance, large, water-saturated logs in old-growth Douglas-fir forests can last for more than 300 years.[29] A study focused on western juniper found that dead juniper trees decay much slower than other mesic old-growth conifers in the Pacific Northwest: 500-600 years for juniper compared to 273-429 years for western hemlock, sitka spruce, and Douglas-fir.[30] And even as this dead wood

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[20] Harmon, M.E. et al. "Combustion of aboveground wood from live trees in megafires, CA, USA." *Forests* (2022) 13(3). https://doi.org/10.3390/f13030391.

[21] Waichler, W.S. et al. "Community characteristics of old-growth western juniper woodlands." *Journal of Range Management* (2001) 54(5): 518–527. https://doi.org/10.2307/4003580.

[22] Lutz, J.A. et al. "The importance of large-diameter trees to the creation of snag and deadwood biomass." *Ecological Processes* (2021) 10. https://doi.org/10.1186/s13717-021-00299-0.

[23] Kelsey, R.G. et al. "Changes in Heartwood Chemistry of Dead Yellow-Cedar Trees that Remain Standing for 80 Years or More in Southeast Alaska." *Journal of Chemical Ecology* (2005) 31: 2653–2670. https://doi.org/10.1007/s10886-005-7618-6.

[24] Maser, C. et al. "From the forest to the sea: a story of fallen trees." *U.S. Forest Service.* Gen. Tech. Report PNW-GTR-229. Pacific Northwest Research Station, Portland, OR (1988). https://doi.org/10.2737/PNW-GTR-229; Harmon, M.E. and C. Hua. "Coarse woody debris dynamics in two old-growth ecosystems. Comparing a deciduous forest in China and a conifer forest in Oregon." *Bioscience* (1991) 41(9): 604–610. https://doi.org/10.2307/1311697; Bradford, M.A. et al. "Belowground community turnover accelerates the decomposition of standing dead wood." *Ecology* (2021) 102(11). https://doi.org/10.1002/ecy.3484.

[25] Bradford, M.A. et al. "Belowground community turnover accelerates the decomposition of standing dead wood." *Ecology* (2021) 102(11). https://doi.org/10.1002/ecy.3484.

[26] Dunn, C.J. and J.D. Bailey. "Temporal dynamics and decay of coarse wood in early seral habitats of dry-mixed conifer forests in Oregon's Eastern Cascades." *Forest Ecology and Management* (2012) 276: 71–81. https://doi.org/10.1016/j.foreco.2012.03.013.

[27] Mellen-McLean, K. and J.L. Ohmann. "Snag dynamics in western Oregon and Washington." U.S. Department of Agriculture, Forest Service (2016). https://apps.fs.usda.gov/r6_decaid/views/snag_dynamics.html.

[28] Harmon, M.E. et al. "Ecology of coarse woody debris in temperate ecosystems." *Advances in Ecological Research* (1986) 34: 59–234. https://doi.org/10.1016/S0065-2504(03)34002-4.

[29] Means, J.E. et al. "Comparison of decomposition models using wood density of Douglas-fir logs." *Canadian Journal of Forest Research* (1985) 15(6): 1092–1098. https://doi.org/10.1139/x85-178.

[30] Waichler, W.S. et al. "Community characteristics of old-growth western juniper woodlands." *Journal of Range Management* (2001) Vol. 54(5): 518–527. https://doi.org/10.2307/4003580.

decomposes, not all of its carbon is lost to the atmosphere—some is absorbed into the forest soil.[31] Conversely, logging releases much of the stored forest carbon to the atmosphere in a relatively short time.[32] Substantial quantities of logging debris will decompose or be burned. The milling of logs into products can quickly release stored carbon from the harvested tree boles. And products like pulp, paper, and biofuel have a very short retention time before being emitted as carbon dioxide (or methane if deposited in a landfill).

Western Oregon BLM forestlands illustrate the significance of the carbon values managed by BLM. These lands contain a disproportionate amount of carbon stored in BLM-managed MOG. These forestlands contain 376 ± 20 million short tons, 56% of which is contained in MOG forestlands (despite MOG making up only 46% of the western Oregon BLM forestland area), as illustrated in figures 3 and 4. Western Oregon BLM forestland total carbon makes up 28% of the total carbon on all BLM forestlands and represents 2% of the total carbon on *all public forestlands* in the contiguous U.S. despite making up only 0.9% of total forest area on public forestlands in the contiguous U.S. (including all FIA ownership classes except for private lands; i.e., National Forest, National Park Service, Bureau of Land Management, Fish and Wildlife Service, Department of Defense, other federal lands, state, county and municipal, and other local government public lands). The MOG on western Oregon BLM forestlands makes up 16% of total carbon on all BLM forestlands. Data used for these estimates and for figures 3 and 4 can be found in the Appendix in tables A3 through A5.

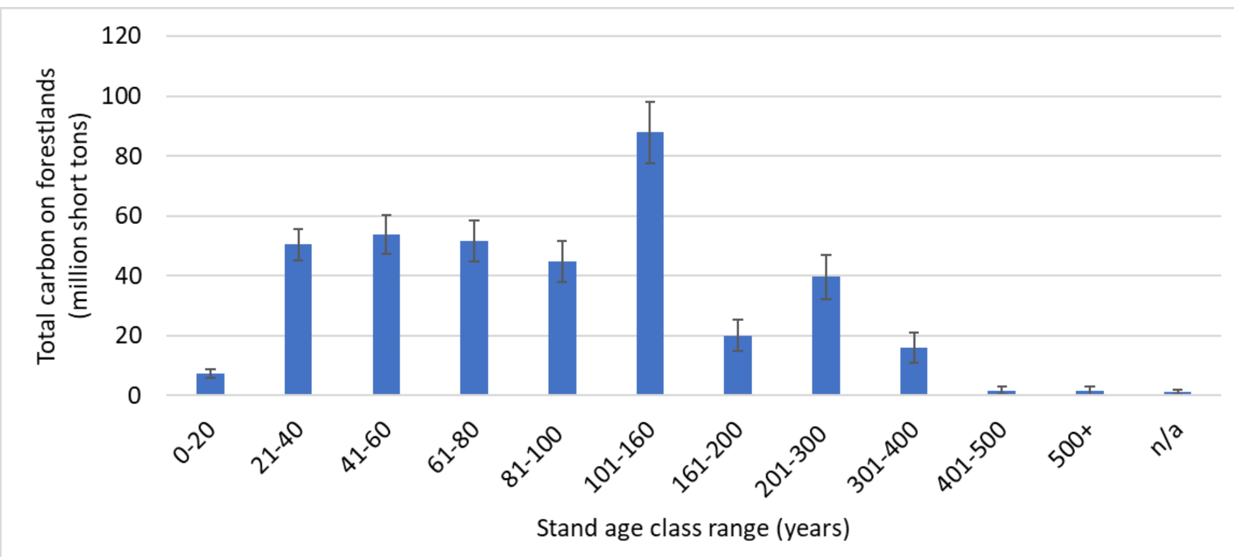

Figure 3. Total carbon on western Oregon BLM forestlands vs. stand age class; data queried using EVALIDator from FIA.

[31] Magnússon, R.Í. et al. "Tamm Review: Sequestration of carbon from coarse woody debris in forest soils." *Forest Ecology and Management* (2016) 377: 1–15. https://doi.org/10.1016/j.foreco.2016.06.033.

[32] Law, B.E. et al. "Land use strategies to mitigate climate change in carbon dense temperate forests." *Proceedings of the National Academy of Sciences* (2018) 115(14): 3663–3668. https://doi.org/10.1073/pnas.1720064115; Hudiburg, T.W. et al. "Meeting GHG reduction targets requires accounting for all forest sector emissions." *Environmental Research Letters* (2019) 14(9). https://doi.org/10.1088/1748-9326/ab28bb; Sterman, J. et al, "Does wood bioenergy help or harm the climate?" *Bulletin of the Atomic Scientists* (2022) 78(3): 128–138. https://doi.org/10.1080/00963402.2022.2062933.

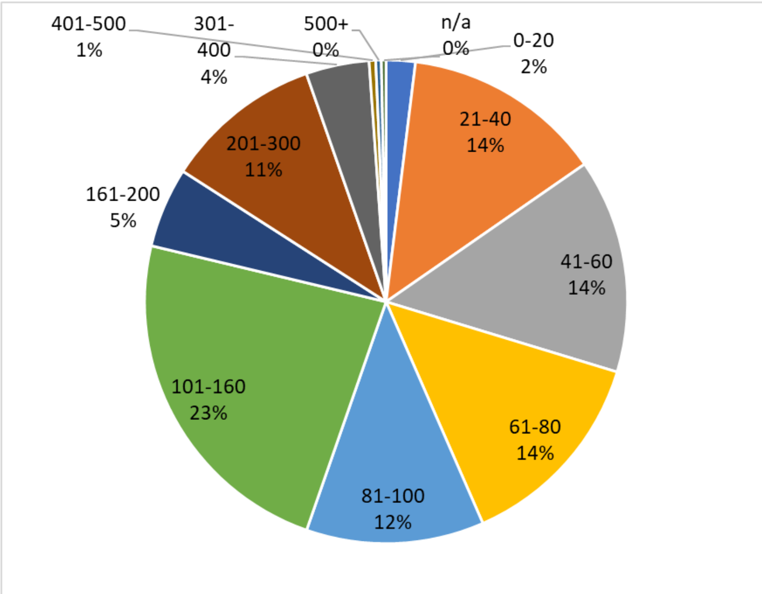

Figure 4. Same data shown in figure 3 but in different format (Total carbon on western Oregon BLM forestlands sorted by age class; data queried using EVALIDator from FIA).

ii. Mature forests and trees provide critical ecological co-benefits.

Scientists have long recognized that mature forests across the country possess unique ecological features and complexity that support biodiversity and provide other benefits. One leading forest ecology textbook argues that the "mature forest stage" is when "the initial cohort of trees lose their youthful appearance," "[o]verstory trees will achieve most of their height growth and crown spread," "epicormic or other adventitious branch systems may begin developing," and "[d]ecadent canopy and bole features . . . become more abundant."[33] Thanks in large part to the development of these features, mature and old-growth forests provide diverse habitat for wildlife and vegetation that younger forests cannot provide.

As reflected in Executive Order 14072[34] and discussed in more detail below, the benefits of this complexity are readily borne out in the places where mature forests and trees have been allowed to develop.[35] Further logging of mature and old-growth forests in the United States damages these foundations, compounding the ongoing biodiversity crisis.

The species that rely on mature and old-growth forests on BLM lands are too numerous to list, but a few examples illustrate the point. In western Oregon, BLM forests directly overlay the range of numerous species listed under the Endangered Species Act ("ESA"), providing vital habitat for such species' survival and recovery. Species such as the marbled murrelet, northern

[33] Jerry F. Franklin, K. Norman Johnson & Debora L. Johnson, "Ecological Forest Management," *Waveland Press* (2018).

[34] Exec. Order No. 14,072, 87 Fed. Reg. 24,851, 24,851 (April 22, 2022).

[35] Brandt, P. et al. "Multifunctionality and biodiversity: Ecosystem services in temperate rainforests of the Pacific Northwest, USA." *Biological Conservation* (2014) Vol. 169: 362–371. https://doi.org/10.1016/j.biocon.2013.12.003.

spotted owl, and several stocks of salmon and steelhead rely on MOG for habitat and climate moderation. Between 1985 and 2013, the total northern spotted owl population declined at a rate of 4% each year.[36] Since 2014, spotted owl population declines have accelerated further, in large part due to competition with barred owls.[37] Barred owls are able to adapt to a variety of habitat types, whereas northern spotted owls rely almost exclusively on MOG stands with relatively dense canopies. In fragmented landscapes, barred owls have a survival advantage relative to spotted owls, but that survival advantage diminishes in landscapes with a higher proportion of older forest.[38] Thus, when MOG is removed or degraded, barred owls outcompete spotted owls, contributing to further spotted owl declines.

In 2020, the U.S. Fish and Wildlife Service found that the northern spotted owl is in danger of extinction throughout all of its range (in large part due to barred owl competition) and that the spotted owl warrants uplisting to "endangered" status under the ESA.[39]

Pinyon-juniper woodlands also provide vital habitat for imperiled species. For example, the U.S. Fish and Wildlife Service is currently considering a petition to list the pinyon jay for protection under the Endangered Species Act.[40] The pinyon jay's habitat includes pinyon-juniper ecosystems.[41]

Meanwhile, BLM-managed Alaska forests contain many forest types including white and black spruce; white, red, and jack pine; various firs; longleaf and slash pine; aspen and birch; and alder and maple, making up the interior boreal Alaskan forests. Boreal forests provide essential habitat for many important species including birds such as the varied thrush, American three-toed woodpecker, black-backed woodpecker, violet-green swallow, hermit thrush, white-crowned sparrow, belted kingfisher, dark-eyed junco, olive-sided flycatcher, blackpoll warbler, rusty blackbird, Wilson's warbler, and birds of prey such as the northern hawk owl, boreal owl, great gray owl, great horned owl, merlin, red-tailed hawk, sharp-shinned hawk, and northern goshawk. They also provide habitat for various small and large mammals such as the Keen's mouse, kenai marten, kenai red squirrel, and kenai brown bear.[42]

Many of these species, including the northern goshawk, depend on MOG habitat for cover and prey. MOG also provides biodiverse understory development for many grasses and flowers, also

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[36] Dugger, K.M. et al. "The effects of habitat, climate, and Barred Owls on long-term demography of Northern Spotted Owl." *The Condor: Ornithological Applications* (2016) 118(1): 57–116. https://doi.org/10.1650/CONDOR-15-24.1.

[37] Franklin, A.B. et al. "Range-wide declines of northern spotted owl populations in the Pacific Northwest: A meta-analysis." *Biological Conservation* (2021) 259. https://doi.org/10.1016/j.biocon.2021.109168.

[38] Wiens, J.D. et al. "Competitive interactions and resource partitioning between northern spotted owls and barred owls in western Oregon." *Wildlife Monographs* (2014) 185(1): 1–50. https://doi.org/10.1002/wmon.1009.

[39] Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; 12-Month Finding for the Northern Spotted Owl, 85 Fed. Reg. 81,144 (Dec. 15, 2020).

[40] Petition to List the Pinyon Jay (*Gymnorhinus cyanocephalus*) as Endangered or Threatened under the Endangered Species Act, submitted by Defenders of Wildlife to U.S. Fish and Wildlife Service on April 25, 2022.

[41] *Id.*

[42] Alaska Department of Fish & Game. *Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources - A Comprehensive Wildlife Conservation Strategy Emphasizing Alaska's Nongame Species*. (2006) 653–672. https://www.adfg.alaska.gov/static/species/wildlife_action_plan/cwcs_full_document.pdf.

critical to many wildlife species. Dead snags and downed logs in MOG forests provide insect foraging for birds like woodpeckers. This foraging results in nesting cavities for many other birds and small mammals. MOG forests and trees also provide important habitat for raptors and grouse.[43] While boreal forests experience frequent disturbances naturally and do not have the same level of MOG as coastal temperate rainforests in Alaska, MOG is still common in riparian zones and flood plains within boreal forests, providing critical ecosystem services.[44]

MOG forests also interact with other landscape features to enhance biodiversity. Riparian zones, critical floodplains, and land adjacent to bodies of water like streams and rivers are also commonly located in mature and old-growth forests that regulate water temperature, provide critical inputs of woody debris, and stabilize streambanks.[45] These zones provide water for a range of wildlife and cool, moist growing conditions for many vegetative species.[46] The bigger, older trees that form the core of mature and old-growth forests play an important part in the hydrological cycle. Forests generally circulate precipitation via uptake of water from roots to canopies and release water back to the atmosphere by evapotranspiration leakage through leaf pores. In pinyon and juniper woodlands, a phenomenon called soil water repellency is facilitated through a hydrophobic soil layer that "may act to divert water deeper into soils and away from surface evaporation," which would help increase drought resistance.[47] Evapotranspiration in trees increases as trees get older and bigger because leaf area is related to site water balance and soil water storage/retention, and larger trees have more leaf area and greater water balance.[48]

Additionally, the complex canopies associated with mature and old-growth forests help regulate the rate at which moisture and heat are exchanged with the atmosphere, which in turn influences water retention and the makeup of forest ecosystems. In the temperate zone, logging large canopy trees results in drier conditions, because the amount of sunlight and heat reaching the

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[43] Haggstrom, D.A. and D.G. Kelleyhouse, "Silviculture and wildlife relationships in the boreal forest of Interior Alaska." *The Forestry Chronicle* (1996) 72(1). https://www.adfg.alaska.gov/static/lands/ecosystems/pdfs/haggstrom_kelleyhouse.pdf.

[44] *Id.*; Kneeshaw, D. et al. "Is Management or Conservation of Old Growth Possible in North American Boreal Forests?" In: "Ecology and Recovery of Eastern Old-Growth Forests." *Island Press* (2018). Edited by A.M. Barton and W.S. Keeton. https://doi.org/10.5822/978-1-61091-891-6_8.

[45] Pypker, T.G. et al. "The role of epiphytes in rainfall interception by forests in the Pacific Northwest. I. Laboratory measurements of water storage." *Canadian Journal of Forest Research* (2006) 36(4). https://doi.org/10.1139/x05-298; Crampe, E.A. et al. "Fifty years of runoff response to conversion of old-growth forest to planted forest in the H. J. Andrews Forest, Oregon, USA." *Hydrological Processes* (2021) 35(5). https://doi.org/10.1002/hyp.14168.

[46] Harr, R.D. "Fog drip in the Bull Run Municipal Watershed, Oregon." *Journal of the American Water Resources Association* (1982) 18(5): 785–789. https://doi.org/10.1111/j.1752-1688.1982.tb00073.x; Crampe, E.A. et al. "Fifty years of runoff response to conversion of old-growth forest to planted forest in the H. J. Andrews Forest, Oregon, USA." *Hydrological Processes* (2021) 35(5). https://doi.org/10.1002/hyp.14168; Wondzell, S.M. "The influence of forest health and protection treatments on erosion and stream sedimentation in forested watersheds of Eastern Oregon and Washington." *Northwest Science* (2001) 75: 128–140. https://research.libraries.wsu.edu/xmlui/handle/2376/989; Wheeling, K. "How forest structure influences the water cycle." *Eos* (2019) 100. https://doi.org/10.1029/2019EO134709.

[47] Robinson, D.A. et al. "Soil water repellency: a method of soil moisture sequestration in Pinyon-Juniper Woodland." *Soil Science Society of America Journal: Forest, Range & Wildland Soils* (2010) 74(2): 624–634. https://doi.org/10.2136/sssaj2009.0208.

[48] Grier, C.G. and S.W. Running. "Leaf Area of Mature Northwestern Coniferous Forests: Relation to Site Water Balance." *Ecology* (1977) 58(4). https://doi.org/10.2307/1936225.

ground can cause more evaporative losses and higher surrounding temperatures.[49] Logging and development are also known to produce downwind continental interiors with declining rainfall and water availability that heighten drought and wildfire risks.[50]

And MOG forests help regulate microclimates and stream temperatures through shade and delivery of woody debris to streams, as well as help filter run-off to maintain cool, clean water supplies for downstream communities and aquatic species. The protection of MOG along streambanks—such as through expanded buffers—can help minimize sedimentation, erosion, stream temperature increases, and reduction in woody debris delivery from logging farther away from streambanks. But it cannot compensate for logging that targets MOG beyond stream buffers.

Another critical below-ground function of older forests is mycorrhizae support found in many species, including Douglas-fir forests on BLM lands. Study after study has revealed that soil biota, particularly fungi that form symbioses with plant roots (mycorrhizae), provide a suite of ecosystem services that support the integrity and resiliency of natural and human communities.[51] Mycorrhizae are known to reduce erosion and nutrient loss,[52] increase plant water use efficiency and retention (which improves cooling capacity in the landscape),[53] store carbon in the ground,[54]

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[49] Wheeling, K. "How forest structure influences the water cycle." *Eos* (2019) 100. https://doi.org/10.1029/2019EO134709; Perry, T.D. and J.A. Jones. "Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA." *Ecohydrology* (2017) 10(2): 1–13. https://doi.org/10.1002/eco.1790.

[50] Ellison, D. et al. "Trees, forests and water: Cool insights for a hot world." *Global Environmental Change* (2017) 43: 51–61. https://doi.org/10.1016/j.gloenvcha.2017.01.002.

[51] Markovchick, L.M. et al. "The gap between mycorrhizal science and application: existence, origins, and relevance during the United Nation's [sic] Decade on Ecosystem Restoration." *Restoration Ecology* (2023) 31(4). https://doi.org/10.1111/rec.13866.

[52] Burri, K. et al. "Mycorrhizal fungi protect the soil from wind erosion: a wind tunnel study." *Land Degradation & Development* (2011) 24(4): 385–392. https://doi.org/10.1002/ldr.1136; Mardhiah, U. et al. "Arbuscular mycorrhizal fungal hyphae reduce soil erosion by surface water flow in a greenhouse experiment." *Applied Soil Ecology* (2016) 99: 137–140. https://doi.org/10.1016/j.apsoil.2015.11.027.

[53] Querejeta, J.I. et al. "Differential modulation of host plant $\delta^{13}C$ and $\delta^{18}O$ by native and nonnative arbuscular mycorrhizal fungi in a semiarid environment." *New Phytologist* (2005) 169(2): 379–387. https://doi.org/10.1111/j.1469-8137.2005.01599.x; Gehring, C.A. et al. "Tree genetics defines fungal partner communities that may confer drought tolerance." *Proceedings of the National Academy of Sciences* (2017) 114(42): 11169–11174. www.pnas.org/cgi/doi/10.1073/pnas.1704022114; Wu, Q.-S. and R.-X. Xia. "Arbuscular mycorrhizal fungi influence growth, osmotic adjustment and photosynthesis of citrus under well-watered and water stress conditions." *Journal of Plant Physiology* (2006) 163(4): 417–425. https://doi.org/10.1016/j.jplph.2005.04.024.

[54] Orwin, K.H. et al. "Organic nutrient uptake by mycorrhizal fungi enhances ecosystem carbon storage: a model-based assessment." *Ecology Letters* (2011) 14(5): 493–502. https://doi.org/10.1111/j.1461-0248.2011.01611.x; Nautiyal, P. et al. "Role of glomalin in soil carbon storage and its variation across land uses in temperate Himalayan regime." *Biocatalysis and Agricultural Biotechnology* (2019) 21. https://doi.org/10.1016/j.bcab.2019.101311.

help plants adapt to changes in climate,[55] and resist pests and pathogens.[56]

A majority of boreal forest soil-stored carbon is in roots and root-associated microorganisms (including mycorrhizal fungi).[57] Moreover, improved plant nutrient access due to mycorrhizal symbioses increases carbon sequestration.[58] Fungal hyphae also produce exudates that promote the formation of soil aggregates, stabilizing soil and supporting continued carbon sequestration in the soil.[59]

Mycorrhizae enhance nutrient retention in vegetation, mycelium and soils—decreasing leaching that negatively affects water quality.[60] Mycorrhizal mycelia aggregate soil particles, improving soil porosity, and enhancing water infiltration and moisture retention.[61] They mediate hydrological functioning by modulating surface soil-to-water attraction and repellency.[62] Additionally, in Douglas-fir stands, "EM [ectomycorrhizal] networks may increase in importance for forest regeneration where climate change increases water stress."[63] Research shows that the "[g]ermination and survival of seedlings linked into the network of older Douglas-fir trees was substantially greater in the very dry climate compared to the wet climate due to the "transfer of water to the new germinants. In the dry climate especially, the mycorrhizal network appeared to

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[55] Gehring, C.A. et al. "Tree genetics defines fungal partner communities that may confer drought tolerance." *Proceedings of the National Academy of Sciences* (2017) 114(42): 11169–11174. www.pnas.org/cgi/doi/10.1073/pnas.1704022114; Patterson, A. et al. "Common garden experiments disentangle plant genetic and environmental contributions to ectomycorrhizal fungal community structure." *New Phytologist* (2018) 221(1): 493–502. https://doi.org/10.1111/nph.15352.

[56] Reddy, B.N. et al. "Approach for enhancing mycorrhiza-mediated disease resistance of tomato damping-off." *Indian Phytopathology* (2006) 59(3): 299–304. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.921.5456; Rinaudo, V. et al. "Mycorrhizal fungi suppress aggressive agricultural weeds." *Plant and Soil* (2009) 333: 7–20. https://doi.org/10.1007/s11104-009-0202-z.

[57] Clemmensen, K.E. et al. "Roots and associated fungi drive long-term carbon sequestration in boreal forest." *Science* (2013) 339(6127):1615–1618 https://science.sciencemag.org/content/339/6127/1615.

[58] *See* Orwin, K.H. et al. "Organic nutrient uptake by mycorrhizal fungi enhances ecosystem carbon storage: a model-based assessment." *Ecology Letters* (2011) 14(5): 493–502.

[59] *See* Nautiyal, P. et al. "Role of glomalin in soil carbon storage and its variation across land uses in temperate Himalayan regime." *Biocatalysis and Agricultural Biotechnology* (2019) 21. https://doi.org/10.1016/j.bcab.2019.101311.

[60] van der Heijden, M.G. "Mycorrhizal fungi reduce nutrient loss from model grassland ecosystems." *Ecology* (2010) 91(4): 1163–1171. https://doi.org/10.1890/09-0336.1.

[61] Augé, R.M. et al. "Moisture retention properties of a mycorrhizal soil." *Plant and Soil* (2001) 230: 87–97. https://doi.org/10.1023/A:1004891210871; Rillig, M.C. and D.L. Mummey. "Mycorrhizas and soil structure." New Phytologist (2006) 171: 41– 53 https://doi.org/10.1111/j.1469-8137.2006.01750.x.

[62] Rillig, M.C. et al. "Mycelium of arbuscular mycorrhizal fungi increases soil water repellency and is sufficient to maintain water-stable soil aggregates." *Soil Biology and Biochemistry* (2010) 42(7): 1189–1191. https://doi.org/10.1016/j.soilbio.2010.03.027; Zheng, W. et al. "Ectomycorrhizal fungi in association with *Pinus sylvestris* seedlings promote soil aggregation and soil water repellency." *Soil Biology and Biochemistry* (2014) 78: 326–331. https://doi.org/10.1016/j.soilbio.2014.07.015.

[63] Bingham, M. and S.W. Simard. "Do mycorrhizal network benefits to survival and growth of interior Douglas-fir seedlings increase with soil moisture stress?" *Ecology and Evolution* (2011) 1(3): 306–316. https://doi.org/10.1002/ece3.24.

extend the niche breadth of interior Douglas-fir seedlings."[64] This behavior in different climates is due to the dominant interactions in these ecosystems. In the dry Douglas-fir forest, "positive or mutualistic interactions dominate," which indicates why the EM networks are so critical. In moist Douglas-fir forests, the richness of this habitat with high species diversity and lush growing conditions leads to tree and stand competition interactions outweighing those of EM networks.[65] Thus, older trees are critical to the survival of forests in drier ecosystems because of EM networks. Removal of older trees that serve as hubs directing the flow of water and nutrients could significantly disrupt these networks.

iii. BLM manages tens of millions of acres of forested landscapes and has an important role in protecting MOG.

BLM manages a significant amount of forest and, in particular, mature and old-growth forests. The estimated amounts of BLM holdings that are forested vary significantly. The USFS-BLM MOG Inventory identified 34.2 million acres of BLM holdings to be forestlands,[66] and BLM's *Public Land Statistics 2021* says there are 28.4 million acres of forests and woody wetlands.[67] In an earlier analysis, the Forest Service found 37.6 million acres of BLM holdings to be forest and woodland.[68] On its various webpages, BLM reports 48.6 to 59 million acres of forestlands.[69] An analysis by Defenders of Wildlife found 28.9 million acres of forested ecosystems on BLM lands in the 11 western states,[70] while BLM's *Public Land Statistics 2021* reports 16,392,831 acres.[71] Regardless of the estimate, it remains clear that forests—and particularly mature and old-growth forests—are a critical piece of BLM's holdings.

iv. Mature forests are fire-resistant.

Mature trees should not be the focus of efforts to reduce wildfire hazards. Critically, mature and old-growth trees are more resistant to fire than young trees. And rate of fire spread is typically dictated by the quantity of highly flammable foliage and branches in smaller (drier) trees and

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[64] Simard, S.W. et al. "Meta-networks of fungi, fauna and flora as agents of complex adaptive systems." In: "Managing forests as complex adaptive systems: building resilience to the challenge of global change." *Routledge* (2013) 133–164. Edited by K. Puettman, C. Messier, K. Coates. https://www.researchgate.net/publication/282661300_Meta-networks_of_fungi_fauna_and_flora_as_agents_of_complex_adaptive_systems.

[65] *Id.*

[66] U.S. Forest Service and Bureau of Land Management. *Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and Bureau of Land Management: Fulfillment of Executive Order 14072, Section 2(b)*. (2023). FS-1215a. https://www.fs.usda.gov/sites/default/files/mature-and-old-growth-forests-tech.pdf.

[67] Bureau of Land Management. "Public Land Statistics 2021," Tables 2-5 and 2-6. (2022) 206: 41–43. https://www.blm.gov/sites/default/files/docs/2022-07/Public_Land_Statistics_2021_508.pdf.

[68] Oswalt, et al. "Forest Resources of the United States, 2017." *U.S. Forest Service*. Gen. Tech. Report WO-97, Washington Office, Washington, DC. https://doi.org/10.2737/WO-GTR-97.

[69] Bureau of Land Management, *Forests and Woodlands* https://www.blm.gov/programs/natural-resources/forests-and-woodlands (last visited June 13, 2023).

[70] Defenders of Wildlife, et al. August 30, 2022. Re: Request for Information on Federal Old-Growth and Mature Forests, 87 FR 42493. Letter to Deb Haaland, Secretary of the Interior. Appendix 1.

[71] Bureau of Land Management. "Public Land Statistics 2021," Tables 2-5 and 2-6. (2022) 206: 41–43. https://www.blm.gov/sites/default/files/docs/2022-07/Public_Land_Statistics_2021_508.pdf.

shrubs.[72] A 2008 study found that industrial plantations (with mostly young trees) burn much more severely than older forests.[73] Older trees typically do not contribute significantly to the rate of fire spread because of their high moisture content, which results in significant amounts of energy and time for them to ignite. Mature and old-growth trees can contribute to burn duration if they ignite, but containing a fire usually involves slowing the rapid spread of wildfire, which is typically correlated with ladder fuels like smaller trees and shrubs.[74]

Individual trees often develop many defenses against fire as they mature, including growing thick bark, pruning lower branches, growing taller so the canopy is farther from the ground, and developing more open crowns.[75] Mature pines, cedars, Douglas-fir, western larch, and giant Sequoia are all common western forest types with very developed fire resistance.[76] Even fire-intolerant species like white, grand, and other true fir species are more likely to survive wildfire if they have developed into maturity.[77] Some conifers that appear to have been killed by fires will grow new needles and shoots in the spring.[78] Stands of mature and old-growth trees typically have larger moisture contents, resulting in less proportionate biomass that is available to burn. This moisture combined with larger basal area also results in mature stands having increased shade and humidity as well as lower temperatures and wind speeds, improving overall fire resistance.[79]

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[72] Rothermel, R.C. "How to predict the spread and intensity of forest and range fires." *U.S. Forest Service.* Gen. Tech. Report INT-143. Intermountain Forest and Range Experiment Station, Ogden, UT. (1983) https://doi.org/10.2737/INT-GTR-143; Anderson, H.E. "Aids to determining fuel models for estimating fire behavior." *U.S. Forest Service.* Gen. Tech. Report GTR-INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT (1982). https://doi.org/10.2737/INT-GTR-122; Agee, J.K. and C.N. Skinner. "Basic principles of forest fuel reduction treatments." *Forest Ecology and Managemen*t (2005) 211(1-2): 83–96. https://doi.org/10.1016/j.foreco.2005.01.034; Robert E. Keane, *Wildland Fuel Fundamentals and Applications* (2015). https://doi.org/10.1007/978-3-319-09015-3.

[73] Zald, H.S.J. and C. J. Dunn. "Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape." *Ecological Applications* (2018) 28: 1068-1080. https://doi.org/10.1002/eap.1710.

[74] Rothermel, R.C. "How to predict the spread and intensity of forest and range fires." *U.S. Forest Service.* Gen. Tech. Report INT-143. Intermountain Forest and Range Experiment Station, Ogden, UT. (1983) https://doi.org/10.2737/INT-GTR-143; Anderson, H.E. "Aids to determining fuel models for estimating fire behavior." *U.S. Forest Service.* Gen. Tech. Report GTR-INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT (1982). https://doi.org/10.2737/INT-GTR-122; Agee, J.K. and C.N. Skinner. "Basic principles of forest fuel reduction treatments." *Forest Ecology and Management* (2005) 211(1-2): 83–96. https://doi.org/10.1016/j.foreco.2005.01.034; Robert E. Keane, *Wildland Fuel Fundamentals and Applications* (2015). https://doi.org/10.1007/978-3-319-09015-3.

[75] James K. Agee, *Fire Ecology of Pacific Northwest Forests*, 121–24 (1993); Brown, P.M. et al. "Identifying old trees to inform ecological restoration in montane forests of the central Rocky Mountains, USA." *Tree Ring Research* (2019) 75(1): 34–48. https://doi.org/10.3959/1536-1098-75.1.34.

[76] Stevens, J.T. "Fire resistance trait data for 29 western North American conifer species – U.S. Geological Survey data release." (2020). https://doi.org/10.5066/P97F5P7L; Habeck, R.J. "Fire Effects Information System (FEIS): Sequoiadendron giganteum." *U.S. Forest Service* (1992). https://www.fs.usda.gov/database/feis/plants/tree/seqgig/all.html (last visited June 13, 2023).

[77] Zouhar, K. "Fire Effects Information System (FEIS): Abies concolor." *U.S. Forest Service* (2001). https://www.fs.usda.gov/database/feis/plants/tree/abicon/all.html (last visited June 13, 2023).

[78] Hanson, C.T. and M.P. North. "Post-fire survival and flushing in three Sierra Nevada conifers with high initial crown scorch." *International Journal of Wildland Fire* (2009) 18(7): 857–864. https://doi.org/10.1071/wf08129.

[79] Countryman, C.M. "Old-growth conversion also converts fire climate." *U.S. Forest Service, Fire Control Notes* (1956) 17(4): 15–19. https://www.fs.usda.gov/sites/default/files/legacy_files/fire-management-today/017_04.pdf;

When mature trees are affected by fire, they often survive with their carbon stores intact and continue to grow.[80] Even when severe fire does kill mature trees, field research indicates that only a relatively small amount of their carbon is combusted into the atmosphere, and the remainder can remain in the forest for decades or even centuries, as the trees slowly decompose.[81] This is why, even in dry forests, on a per-acre basis, emissions from logging are generally greater than those from wildfire and often substantially so.

As a result, total national carbon emissions from logging exceed those from fire, even though in many areas more acres of land are affected by fire.[82] Similarly, in a first of its kind assessment from 2018 focused on carbon emissions associated with federal lands, the United States Geological Survey estimated that across the conterminous U.S., carbon emissions from logging of federal forests were more than double those from fire on those lands.[83] Lands in this study were organized by state and include all federal lands, including BLM lands.

v. Pinyon-juniper is an important part of BLM's forest portfolio.

An important element of BLM's MOG holdings is its pinyon-juniper forests and trees. Due to their significant acreage, pinyon pine and juniper woodlands and forests store most of the carbon on forested BLM lands in the conterminous U.S. (figure 5 & Appendix table A6). And, according to an assessment in the recent MOG inventory and report issued by the U.S. Forest Service and BLM, "Pinyon and juniper woodlands are the most abundant forest type in the federally managed inventory of mature and old-growth forests, with nine million acres of old-growth pinyon-juniper across BLM and Forest Service lands and an additional 14 million acres of mature pinyon-juniper."[84]

Kitzberger, T. et al. "Decreases in fire spread probability with forest age promotes alternative community states, reduced resilience to climate variability and large fire regime shifts." *Ecosystems* (2012) 15: 97–112. https://doi.org/10.1007/s10021-011-9494-y; Frey, S.J.K. et al. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." *Scientific Advances* (2016) 2(4). https://doi.org/10.1126/sciadv.1501392; James K. Agee, *Fire Ecology of Pacific Northwest Forests*, (1993); Agee, J.K. and C.N. Skinner. "Basic principles of forest fuel reduction treatments." *Forest Ecology and Management* (2005) 211(1-2): 83–96. https://doi.org/10.1016/j.foreco.2005.01.034.

[80] James K. Agee, *Fire Ecology of Pacific Northwest Forests*, 121–24 (1993); Schwilk, D.W. and D.D. Ackerly. "Flammability and serotiny as strategies: correlated evolution in pines." *Oikos* (2003) 94(2): 326–336. https://doi.org/10.1034/j.1600-0706.2001.940213.x.

[81] Campbell, J.L. et al. "Pyrogenic carbon emission from a large wildfire in Oregon, United States." *Journal of Geophysical Research* (2007) 112(G4). https://doi.org/10.1029/2007JG000451; Harmon, M.E. et al. "Combustion of Aboveground Wood from Live Trees in Megafires, CA, USA." *Forests* (2022) 13(3) 391–413. https://doi.org/10.3390/f13030391; Meigs, G.W. et al. "Forest Fire Impacts on Carbon Uptake, Storage, and Emission: The Role of Burn Severity in the Eastern Cascades, Oregon." *Ecosystems* (2009) 12: 1246–1267. https://doi.org/10.1007/s10021-009-9285-x; Stenzel, J.E. et al. "Fixing a snag in carbon emissions estimates from wildfires." *Global Change Biology* (2019) 25(11): 3985–3994. https://doi.org/10.1111/gcb.14716.

[82] Harris, N.L. et al. "Attribution of net carbon change by disturbance type across forest lands of the conterminous United States." *Carbon Balance and Management* (2016) 11. https://doi.org/10.1186/s13021-016-0066-5.

[83] Merrill, M.D. et al."Federal lands greenhouse emissions and sequestration in the United States: Estimates for 2005-14 – U.S. Geological Survey data release." (2018). https://doi.org/10.5066/F7KH0MK4. Reporting 43 $TgCO_2$/year for logging and 21 $TgCO_2$/year for fire.

[84] *U.S. Forest Service*, "Biden-Harris Administration Announces New Steps for Climate Resilience and Forest Conservation," (Apr. 20, 2023), https://www.fs.usda.gov/news/releases/biden-harris-administration-announces-new-steps-climate-resilience (last visited June 13, 2023).

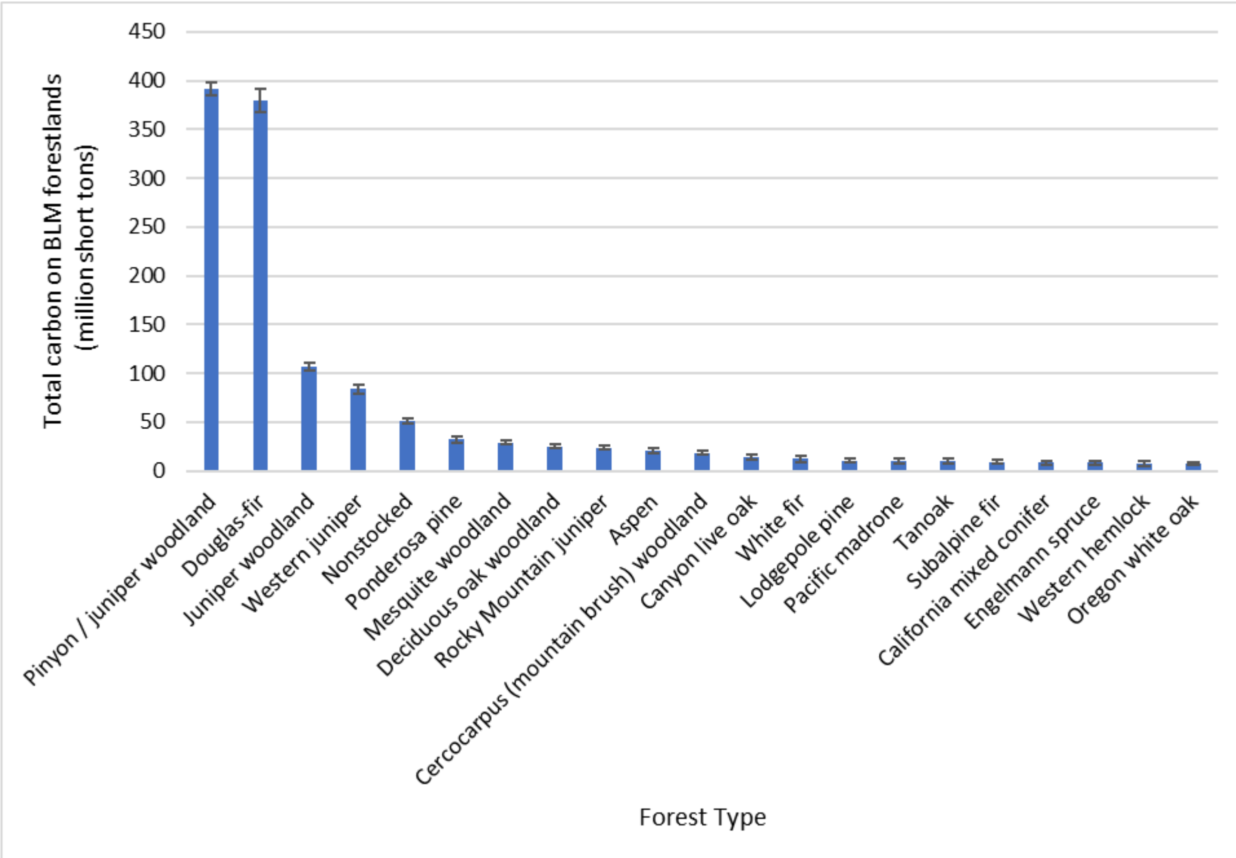

Figure 5. Total carbon on BLM forestlands in the conterminous U.S. vs. forest type (data queried from FIA using EVALIDator—not showing forest types with very minimal carbon stores).

Breaking down these carbon stores by stand age class (figures 6 and 7; FIA-queried data shown in Appendix table A7), most of the carbon is indeed stored in older stands, especially in pinyon-juniper woodlands, which lead the way in stored carbon. More than three-fourths of the total carbon in P-J woodlands is stored in stands over the age of 100 years old.

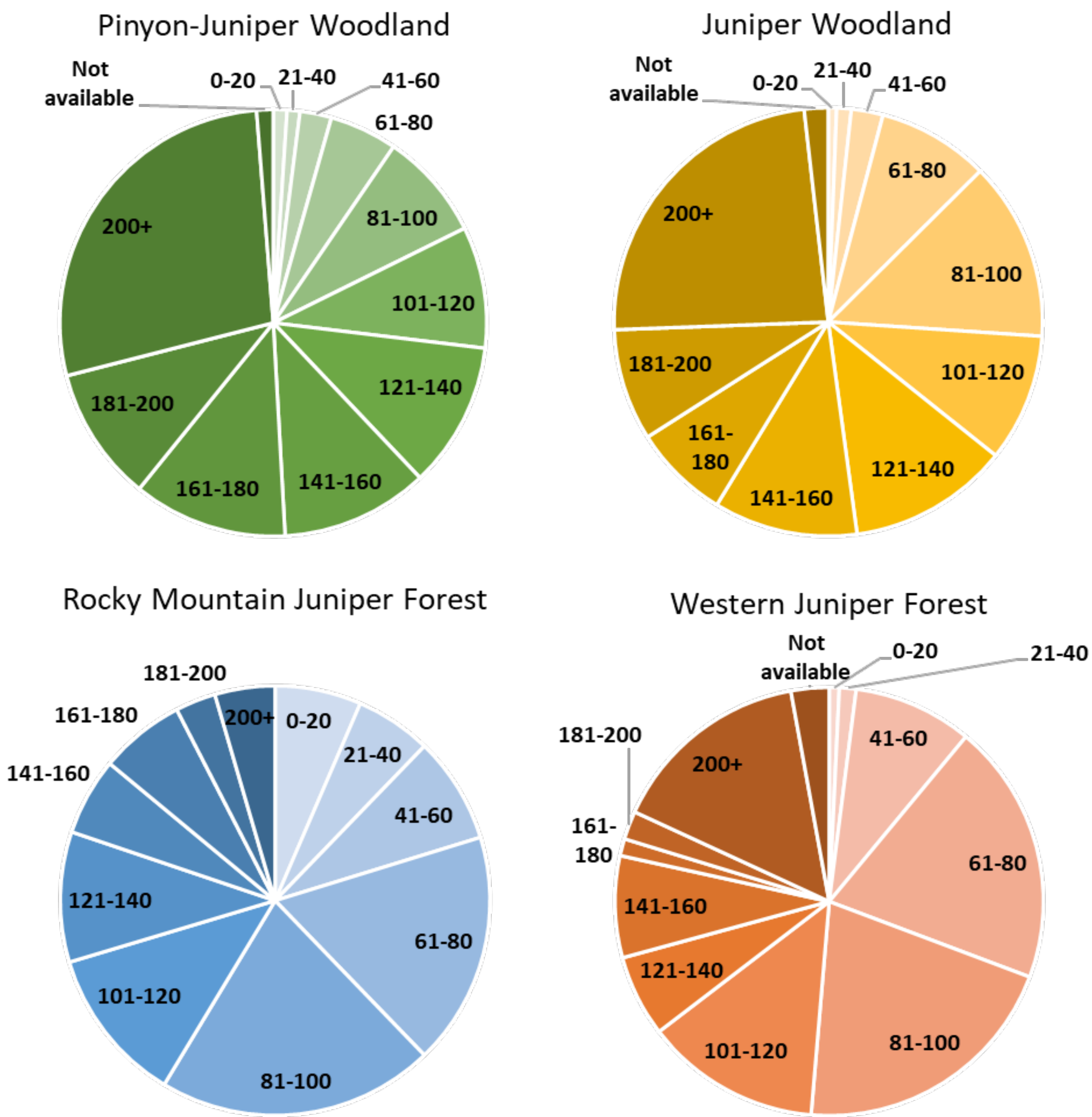

Figure 6. 20-year stand age class breakdown of total carbon in Pinyon-Juniper forest types (data queried from FIA using EVALIDator).

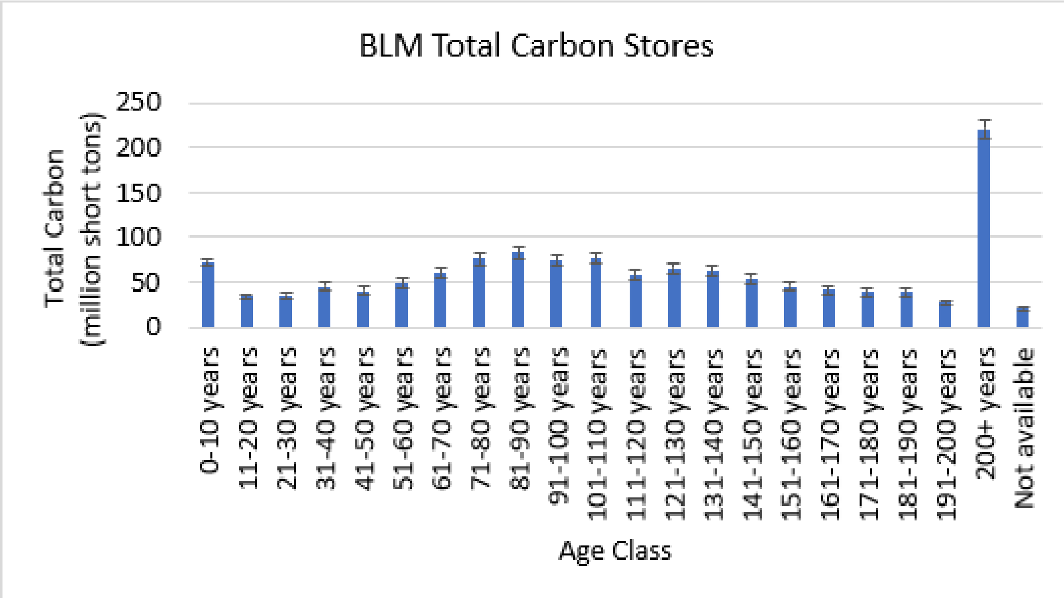

Figure 7. Total carbon stores on BLM forestlands broken down by stand age class. Data queried from FIA using EVALIDator.

In general, areas of MOG pinyon-juniper ecosystems provide important carbon storage and sequestration, biological diversity conservation, and watershed values in arid areas.

B. MOG Is Under Threat from Logging, Including on BLM Lands.

i. Across the country, old-growth forests are at only a small fraction of their historical prevalence, a condition that preserving today's mature forests will help to reverse.

Mature forests and trees remain under threat from logging across the United States, including on lands managed by BLM. Old growth as a proportion of total U.S. forests is well below its pre-colonization level. In the Pacific Northwest, for instance, "the approximated historical extent of old-growth forest . . . was nearly two-thirds . . . of the total land area," but as of 2006, "approximately 72% of the original old-growth conifer forest has been lost to conversion or subjected to intensive forestry practices."[85] As a result of this reckless approach to forest management, federal lands are one of the few remaining strongholds of mature forests and trees. The only way to begin rebuilding the nation's lost old growth and the previously discussed co-benefits associated with it is by protecting extant mature forests and trees. And the best place to do that—the only part of the United States with significant stretches of these essential forest components under cohesive management—is the federal estate.[86]

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[85] Strittholt, J.R. et al. "Status of Mature and Old-Growth Forests in the Pacific Northwest." *Conservation Biology* (2006) 20(2): 363–374. https://www.jstor.org/stable/3591344.

[86] *See, e.g.*, U.S. Forest Service and Bureau of Land Management. *Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and Bureau of Land Management: Fulfillment of Executive Order 14072, Section 2(b)*. (2023). FS-1215a. https://www.fs.usda.gov/sites/default/files/mature-and-old-growth-forests-tech.pdf; DellaSala, D.A. et al. "Mature

Notwithstanding this essential patrimony, reckless logging continues across federal lands. As described in more detail in the next section, on BLM lands work such as the 42 Divide, Poor Windy, and Integrated Vegetation Management projects target significant stretches of mature forests and trees.[87] And the destructive effect of this logging is compounded by similar projects by the U.S. Forest Service.[88]

ii. BLM continues to authorize the logging of mature and old-growth trees.

Logging projects in western Oregon

On its public forestlands in western Oregon, which contain very significant amounts of mature and old-growth forests and trees,[89] BLM has increased the number of logging projects targeting MOG—and increased board feet timber targets—since the adoption of revised resource management plans in 2016.

In 2018, BLM's Lakeview District began implementing the North Landscape project, which authorizes logging on roughly 9,000 acres of northern spotted owl habitat—*i.e.*, mature and old-growth stands.[90] Conservation plaintiffs unsuccessfully challenged the North Landscape project in federal court.[91]

In 2019, BLM authorized the Poor Windy and Evans Creek projects on the agency's Medford District, allowing logging across more than 10,000 acres of MOG.[92] Conservation plaintiffs successfully challenged the Poor Windy and Evans Creek projects in federal court in 2022,[93] yet the agency still plans to auction a timber sale within the Poor Windy project area in July of 2023. Also on BLM's Medford District, the agency recently authorized the "Integrated Vegetation Management for Resilient Lands" program ("IVM").[94] One of the first timber sales offered as part of the program, called the Late Mungers sale, allows the removal of pine and Douglas-fir as

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and old-growth forests contribute to large-scale conservation targets in the conterminous United States." *Frontiers in Forests and Global Change* (2022) 5:979528. https://doi.org/10.3389/ffgc.2022.979528.

[87] Climate Forests Campaign. *Worth More Standing: 10 Climate-Saving Forests Threatened by Federal Logging*. (2022). https://www.climate-forests.org/_files/ugd/73639b_03bdeb627485485392ac3aaf6569f609.pdf; Climate Forests Campaign. *America's Vanishing Climate Forests: How the U.S. Is Risking Global Credibility on Forest Conservation*. (2022). https://www.climate-forests.org/_files/ugd/ae2fdb_b5a2315e3e8b42498b4c269730c3955a.pdf.

[88] *Id.*

[89] *See* Section I.A.i, *supra*.

[90] *See Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, No. 1:19-cv-1810-CL, 2021 WL 5356969, at *9 (D. Or. Aug. 24, 2021).

[91] *See Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, No. 22-35035, 2022 WL 17222416, at *2 (9th Cir. Nov. 25, 2022).

[92] *See Klamath-Siskiyou Wildlands Ctr. v. U.S. Fish & Wildlife Serv.*, No. 1:20-cv-952-AA, 2022 WL 4599259, at *5 (D. Or. Sept. 30, 2022).

[93] *Id.* at *20.

[94] *See* Bureau of Land Management, Integrated Vegetation Management for Resilient Lands Decision Record (Mar. 2, 2022), available at https://eplanning.blm.gov/public_projects/123406/200316524/20055339/250061521/Decision%20Record.pdf (last visited June 13, 2023).

large as 36 inches in diameter—mature if not old-growth trees.[95] IVM and Late Mungers are now subject to a legal challenge in federal court due to impacts on mature and old-growth stands and species dependent on them.[96]

On BLM's Roseburg District, the agency has proposed two projects, 42 Divide and Blue and Gold, that combined will include regeneration harvest (*i.e.*, clearcutting) across 5,200 acres of stands up to 200 years old.[97] However, within these stands, many trees are much older. The forest stand database used by BLM, known as the Forest Operations Inventory ("FOI"), indicates stand age based on the last age-resetting disturbance event, whether logging or fire or otherwise. The database thus does not capture the on-the-ground reality of two-aged or multiple-aged stands, and the public generally is unaware of the potentially large percentage of a proposed logging unit's trees that are much older than the age assigned by FOI and identified in public-facing documents. For example, in the Blue and Gold project area, BLM indicates that stands within Unit 27 have a maximum age of 140 years—already well into mature if not old-growth stages—but in reality the ridge where a logging road will be constructed is filled with huge, towering trees many hundreds of years old that survived a wildfire in the 1800s, the point when FOI deemed the stand age to be reset.[98]

On BLM's Coos Bay District, the Big Weekly Elk project also targets stands up to 170 years old for regeneration harvest (clearcutting),[99] while the Coos Bay Landscape plan authorizes heavy thinning within Late-Successional Reserves and Riparian Reserves, including over 4,000 acres of

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[95] *See* Bureau of Land Management, Late Mungers FAQ (Apr. 21, 2022), available at https://eplanning.blm.gov/public_projects/2018484/200519234/20058044/250064226/20220421_Late%20Mungers%20Fact%20Sheet%20.pdf (last visited June 13, 2023).

[96] *See Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, No. 1:23-cv-519-CL (D. Or. filed April 10, 2023).

[97] *See* Bureau of Land Management, 42 Divide Scoping Letter (Nov. 8, 2021), available at https://eplanning.blm.gov/public_projects/2016400/200500124/20049787/250055970/20211102%2042%20Divide%20EA%20Scoping%20FINAL%20Signed.pdf (last visited June 13, 2023); *see also* Bureau of Land Management, Blue and Gold Scoping Letter (Dec. 5, 2019), available at https://eplanning.blm.gov/public_projects/nepa/1501459/20009776/250011435/Blue_and_Gold_Harvest_Plan_EA_Scoping.pdf (last visited June 13, 2023); *see also* Bureau of Land Management, Blue and Gold Scoping Letter Proposing Additional Harvest Acres (July 8, 2020), available at https://eplanning.blm.gov/public_projects/1501459/200335791/20021326/250027530/20200708%20BG%20Public%20reScoping.pdf (last visited June 13, 2023).

[98] *See* Bureau of Land Management, Blue and Gold Harvest Plan – Proposed Addition Detail Map 3, available at https://eplanning.blm.gov/public_projects/1501459/200335793/20021342/250027546/Proposed%20Addt%20Detail3.pdf (last visited June 10, 2023); *see also* Photos from Unit 27 (Dec. 8, 2022) (on file).

[99] *See* Bureau of Land Management, Big Weekly Elk Final Forest Management Project Environmental Assessment (Oct. 20, 2021), 20, available at https://eplanning.blm.gov/public_projects/123294/200315930/20049507/250055690/2021_10_20_BWE%20EA%20Final.pdf (last visited June 13, 2023). BLM originally proposed clearcutting of a 240-year-old stand within the Big Weekly Elk Project, *id.*, and only deferred clearcutting that unit following public comments expressing concern about the inclusion of this old-growth stand. *See* Bureau of Land Management, Big Weekly Elk – Finding of No Significant Impact (Oct. 21, 2021), 23, available at https://eplanning.blm.gov/public_projects/123294/200315930/20049506/250055689/2021_10_20_BWE%20FONSI.pdf (last visited June 13, 2023).

mature stands.[100] The recently announced Baker's Dozen project, also in the Coos Bay District, further targets stands as old as 150 years.[101] Again, these stand ages drawn from the FOI database do not necessarily capture the on-the-ground reality of two- or multiple-aged stands where expanses of very old stands have survived previous disturbance events, store immense amounts of carbon, and provide vital habitat values and watershed protections.

The N126 and Siuslaw HLB projects on BLM's Northwest Oregon District also target large mature and old trees up to 150 years old through commercial thinning and regeneration prescriptions.[102] Both the N126 and Siuslaw HLB projects are now being litigated in federal court by conservation plaintiffs in large part due to the removal and degradation of mature and old-growth trees and stands within the project areas.[103] In the same district, BLM recently proposed regeneration harvest (clearcutting) on nearly 1,000 acres in stands listed as between 71 and 120 years of age in the McKay Creek project area just west of Portland.[104]

Right-of-way agreements on western Oregon BLM lands

BLM also continues to allow mature and old-growth trees to be cut pursuant to right-of-way agreements the agency enters with adjacent private landowners. Private landowners—generally large timber companies—often assert they must build roads across BLM lands to access timber within their inholdings or checkerboarded land. Although BLM's operative statutes generally support access facilitation, in practice the private companies often target the largest, most valuable trees when laying out routes for road construction across BLM parcels, despite other available routes, then keep the commercial timber and sell it for profit.

Pinyon-juniper woodlands

BLM also authorizes removal of old and mature trees on pinyon-juniper landscapes. For example, in the Bruneau-Owyhee Sage-Grouse Habitat project, juniper trees will be removed on

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[100] *See* Bureau of Land Management, Coos Bay Late-Successional and Riparian Reserve Restoration Management Environmental Assessment (Feb. 13, 2023), 16, available at https://eplanning.blm.gov/public_projects/2012984/200488198/20073705/250079887/Final_EA.pdf (last visited June 13, 2023).

[101] *See* Bureau of Land Management, Baker's Dozen Scoping Letter (Feb. 28, 2023), available at https://eplanning.blm.gov/public_projects/2023471/200546217/20074445/250080627/2023_02_28_BakersDozenForestManagement_Scoping_Letter.pdf (last visited June 14, 2023).

[102] *See* Bureau of Land Management, N126 LSR Landscape Plan Project Final Environmental Assessment (Feb. 22, 2021), 27, available at https://eplanning.blm.gov/public_projects/117556/200284509/20035181/250041378/20210219_N126%20LSR%20Landscape%20Plan%20EA_EA_Final%20With%20Cost%20Updated.pdf (last visited June 13, 2023); *see also* Bureau of Land Management, Siuslaw HLB Landscape Plan Final Environmental Assessment (March 31, 2022), 18, available at https://eplanning.blm.gov/public_projects/1502250/200343409/20056898/250063080/2022_01_20_HLB_EA_final.pdf (last visited June 13, 2023).

[103] *See Cascadia Wildlands v. Adcock*, No. 6:22-cv-767-AA (D. Or. filed May 25, 2022); *Cascadia Wildlands v. Adcock*, No. 6:22-cv-1344-MK (D. Or. filed Sept. 8, 2022).

[104] *See* Bureau of Land Management, McKay Creek Scoping Letter (Feb. 8, 2023), available at https://eplanning.blm.gov/public_projects/2023369/200544690/20073462/250079644/Scoping%20Letter_McKayCreek_InterestedPublic.pdf (last visited June 13, 2023).

617,000 acres of public land in Idaho over 15 years, nominally to restore greater sage-grouse habitat impacted by conifer encroachment that has occurred due to fire suppression.[105] Although BLM asserts it will not target old-growth juniper, it characterizes woodlands in terms of "phases," lumping all age classes together based on canopy cover and expansion status. For example, in the Bruneau Owyhee project, "Phase III" juniper woodlands—those whose expansion has stabilized and have greater than 30% canopy cover—may still be "treated," *i.e.*, removed, as part of the project, including mature and older trees.[106]

Similarly, the Egan and Johnson Basins Restoration project in Nevada authorized "treatment" of over 37,000 acres of pinyon-juniper woodlands to "restore natural site conditions."[107] As in the Bruneau Owyhee project, BLM relied on "phases" of pinyon-juniper woodlands rather than age classes to demarcate treatment prescriptions, thus including large, old trees for removal. Concerned members of the public questioned this characterization and asked the agency for the number of old trees that would be cut down as part of the project. BLM replied that mapping older "trees is not possible nor necessary" and conceded that an undefined number of "older trees may be treated" within the project area.[108]

C. The Rule to Protect MOG from Logging Must Contain Meaningful, Substantive Restrictions.

The agency should adopt a binding rule that secures major drivers of carbon sequestration and durable carbon storage across the forests it manages. The rule needs to meaningfully end logging and removal of mature trees above a set age, and of all trees in mature stands where fire is infrequent. It would give personnel in the field simple, readily administered guardrails on logging decisions and establish uniform national minimum standards for carbon conservation. In sub-mature stands and frequent-fire forests, it would leave intact managers' discretion to log smaller trees (e.g., for fire risk), to supply mills with the same kind of small-diameter logs that come off industrial timberlands, and to preserve additional tree carbon based on local considerations. Research indicates that an age cutoff of 80 years would generally ensure that where logging is authorized most carbon would remain in the forest.

Site-specific conservation measures such as conservation leases and areas of critical environmental concern cannot substitute for a focused rulemaking to protect mature and old-growth trees and forests from logging. Across BLM lands, MOG has common characteristics

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105 *See* Bureau of Land Management, Record of Decision – Bruneau Owyhee Sage-Grouse Habitat Project (Feb. 5, 2019), available at https://eplanning.blm.gov/public_projects/nepa/42342/166379/202761/BOSH_ROD_Signed_020519.pdf (last visited June 13, 2023).

106 *See* Bureau of Land Management, Final Environmental Impact Statement, Bruneau Owyhee Sage-Grouse Habitat Project (Feb. 2018), 14, available at https://eplanning.blm.gov/public_projects/nepa/42342/133231/162835/BOSH_FEIS_FINAL.pdf (last visited June 13, 2023).

107 *See* Bureau of Land Management, Final Environmental Assessment, Egan and Johnson Basins Restoration Project (June 28, 2018), 6, 27, available at https://eplanning.blm.gov/public_projects/nepa/35903/150409/184605/EJB_EA_DOI-BLM-NV-L010-2013-0014-EA_Final_pdf.pdf (last visited June 13, 2023).

108 *Id.* at 170, 173.

that provide essential values to the nation and demand urgent protection. Subjecting each MOG forest or stand (much less tree) to an individual process to assess whether it merits protection would be time-consuming, resource-intensive, and not meaningfully responsive to the rapidly accelerating climate and biodiversity crises. It would also fail to meet the intent of Executive Order 14072. Furthermore, the time-limited nature of conservation leases is poorly suited to MOG protection, and protections from logging must not be contingent on lease applications by non-federal entities. Only a focused rule applicable across BLM lands would adequately protect MOG from logging.

D. BLM Should Swiftly Take the Necessary Steps to Substantively Protect MOG.

In order to implement the important objectives that this proposal embodies, it is essential that BLM promulgate a substantive rule to protect mature and old-growth trees and forests from logging. Failing to promulgate such a rule would have grave consequences for the climate, biodiversity, and other critical values. With so much at stake, BLM should proceed with substantive protections as soon as possible and with robust opportunity for Tribal consultation and public input.

If BLM believes that it cannot establish those protections through this proposal, it should urgently pursue a substantive rulemaking to protect mature and old-growth trees and forests—including a robust analysis in a full environmental impact statement—either as a standalone rule or as a supplement to the current proposal.

II. A RULE PROTECTING MOG FROM LOGGING IS NECESSARY TO FURTHER THE AIMS OF BLM'S PROPOSAL ON THE BUREAU'S HOLDINGS.

A. Protecting MOG Would Advance "Conservation" as a "Use" on Par with Other Uses Under the Multiple-Use Framework.

i. Properly read, the statute requires equal consideration of "conservation," which squarely encompasses protecting MOG.

Protecting mature forests and trees on BLM land from logging is a necessary component of giving conservation equal consideration with other uses. In the proposed rule, the agency rightly recognizes the need to ensure "functioning and productive native ecosystems that supply food, water, habitat, and other ecological necessities" on a continuing basis under FLPMA.[109] And the agency correctly identifies its continuing obligation to "maintain functioning and productive ecosystems and work to ensure their resilience" so that they can "absorb, or recover from, the effects of disturbances and environmental change," including climate change.[110] As described above,[111] BLM's mature forests and trees are ecosystem anchors; they are generally more resilient to disturbance, provide a host of critical co-benefits (e.g., securing watershed integrity),

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[109] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19585 (Apr. 3, 2023) (proposed rule).
[110] *Id.*
[111] *See* Section I.A–B, *supra*.

and actively fight climate change through their enormous carbon sequestration and storage capacity.

Protections for mature forests and trees from logging are consistent with the proposed rule's approach to conservation. FLPMA situates conservation as a "use" for public lands co-equal with other listed uses—it is not secondary or otherwise non-privileged, as the agency acknowledges in the proposed rule. BLM also defines conservation as encompassing "both protection and restoration actions," specifically including "protection of intact, native habitats" and "restoration of degraded habitats."[112] Protecting mature forests and trees safeguards essential habitat and provides for restoring the extent of the unique habitat provided by old growth by letting mature trees grow old.

Protections from logging for mature forests and trees are also a necessary part of putting conservation on equal footing with other uses. As detailed above, the country has degraded and continues to degrade its mature and old-growth forests for timber. Notwithstanding this destructive trend, federal lands constitute one of the last key strongholds of these climate-critical forests. If the agency is defining conservation as including both protection and restoration, then it must implement dedicated protections for mature forests and trees to stop the degradation and start the recovery. And that begins by circumscribing logging.

ii. Protecting mature and old-growth forests will not unduly impair other uses.

The protection of mature and old-growth forests on BLM lands will not unduly impair the agency's discretion to authorize other valid uses, including logging. Mature and old-growth forests demand conservation but represent only a subset of BLM's forestlands. BLM manages millions of acres that do not contain mature and old-growth forests where the agency may accommodate other valid uses of public lands if appropriate.

In regards to western Oregon, where much of the commercially valuable timber managed by BLM is located, the Oregon and California Railroad Lands Act of 1937 ("O&C Act") directs BLM to manage much of these lands consistent with the principle of sustained yield.[113] The O&C Act identifies watershed protection, stream flow regulation, and recreation as other functions and uses to be considered in the agency's determination of annual sustained yield capacity.[114] The proposed rule complements this approach by expressly recognizing ecosystem resilience as essential to the concept of sustained yield land management.[115]

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[112] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19585 (Apr. 3, 2023) (proposed rule).
[113] 43 U.S.C. § 2601.
[114] *Id.*
[115] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,589 (Apr. 3, 2023) (proposed rule).

As of 2016, BLM lands in western Oregon contained over one million acres of forest stands identified as younger than 80 years old that BLM has deemed sources of commercial timber.[116] Using 80 years as a gauge of maturity, these plantations can continue to provide a supply of commercial timber for decades to come. At the same time, protected mature and old-growth stands will continue to offer watershed protection, stream flow regulation, and recreation opportunities in addition to providing vital habitat, climate and fire refugia, carbon storage, and other resilient ecosystem values.

FLPMA directs the agency to protect a whole suite of values—ecological, environmental, air and atmospheric, water resources, and fish and wildlife habitat[117]—all of which the protection of mature and old-growth forests and trees accomplishes. Congress empowered the agency to balance competing uses, to make choices where some lands may be used "for less than all of the resources" possible, and to take into account the long-term needs of future generations "without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output."[118]

Thus, BLM has ample discretion[119] and authority to consider proper siting and to require specific project design features to avoid impacting mature and old-growth forests when authorizing other public land uses. Protecting mature and old-growth forests on public lands is a valid exercise of BLM's statutory authority, is fully within the agency's discretion, and is indeed compelled by the quickening pace of the climate and biodiversity crises.

B. Protecting MOG Would Advance "Mitigation" as Defined in the Proposed Rule Because the Protections Would Avoid Negative Impacts.

In the "Background" section, the agency says the proposed rule reaffirms BLM's adherence to the mitigation hierarchy for *all* resources, which necessarily then includes MOG across all BLM-managed landscapes, from the infrequent-disturbance forests types found in western Oregon, to pinyon-juniper forests spread across the Intermountain West, to the boreal forests of Alaska.

The proposed rule defines "mitigation" to encompass a traditional mitigation hierarchy of "first avoid, then minimize, then compensate" for residual impacts of proposed actions.[120]

The proposed rule also requires mitigation, to the maximum extent possible, to address adverse impacts to important, scarce, or sensitive resources. The proposed rule defines "important

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[116] Bureau of Land Management, Proposed Resource Management Plan/Final Environmental Impact Statement, Western Oregon, Vol. 1 (2016), 310, available at https://eplanning.blm.gov/public_projects/lup/57902/71567/78543/Volume_1_.pdf (last visited June 13, 2023). An additional 1.15 million acres consist of forest stands over the age of 80. *Id.*

[117] 43 U.S.C. § 1701(a)(8).

[118] *Id.* § 1702(c).

[119] As courts have noted, FLPMA "breathes discretion at every pore." *Natural Res. Def. Council v. Hodel*, 624 F. Supp. 1045, 1058 (D. Nev. 1985) (citing *Perkins v. Bergland*, 608 F.2d 803, 806 (9th Cir. 1979)).

[120] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,598 (Apr. 3, 2023) (proposed rule).

resources" as those "that the BLM has determined to warrant special consideration, consistent with applicable law."[121] Given the multiple benefits MOG provides in terms of carbon storage and sequestration, water quality protection, and habitat for biodiversity, and the recognition of these same values by the current administration, MOG constitutes an "important resource."

The proposed rule defines "scarce resources" as those "that are not plentiful or abundant and may include resources that are experiencing a downward trend in condition."[122] In many areas managed by BLM, MOG is no longer plentiful or abundant relative to historic conditions and qualifies as a "scarce resource."

Finally, the proposed rule defines "sensitive resources" as "resources that are delicate and vulnerable to adverse change, such as resources that lack resilience to changing circumstances."[123] Although MOG in many instances *is* more resilient to changing circumstances than younger forests—and is more resistant to fire, as explained above—it is not resilient to outright destruction through logging. Once removed or degraded, forests can take decades to centuries to redevelop MOG characteristics. MOG is thus a sensitive resource in that it is vulnerable to adverse changes from actions that directly target its removal or degradation, and the benefits that are lost cannot be regained for a considerable time.

In the context of MOG, avoiding impacts in the first instance is the best option within the mitigation hierarchy because "minimizing" impacts still results in the destruction or degradation of MOG, and compensation through replacement is not possible on a time-scale relevant to the urgency of the climate and biodiversity crises. Developing MOG can take many decades if not over a century, and storage and sequestration of carbon must take place immediately to address the climate crisis. Furthermore, species dependent on MOG are already rapidly dwindling. For example, merely "minimizing" impacts to MOG on western Oregon BLM lands runs counter to the present needs of the spotted owl and other MOG-reliant and habitat-limited species. Restoration of younger forest stands toward MOG characteristics cannot compensate for MOG habitat loss for species in peril *now*. Mitigation through avoidance of impacts to MOG in the first instance is necessary to conserve and recover the rich biodiversity values of these forests and trees.

When evaluating MOG in the context of mitigation, the White House Council on Environmental Quality's guidance on GHG emissions accounting is a useful reference.[124] Of note, the guidance implicates biogenic emissions from activities such as logging under the same scrutiny as other anthropogenic sources of GHGs like fossil fuel extraction. Research, including studies by the

[121] *Id.*
[122] *Id.*
[123] *Id.*
[124] Council on Environmental Quality. National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change, 88 Fed. Reg. 1196, 1207 (Jan. 9, 2023).

U.S. government,[125] indicates that logging on federal forests is a substantial source of carbon dioxide emissions to the atmosphere.[126]

Avoiding GHG emissions in forest management requires management prescriptions that protect the critical carbon values MOG provides. These emissions include direct and indirect climate pollution from removing, transporting, and milling wood. More specifically, they include emissions from loss of stored carbon during the removal at the forest (in-boundary) and manufacturing and transport process (out-of-boundary) and emissions from logging on site through the entire chain of custody of milling, manufacturing, and transportation.

C. In Many Cases, Protecting MOG Will Protect and Restore Intact, Native Landscapes.

i. The proposal correctly recognizes the many benefits of intact, native landscapes.

A rule to protect mature and old-growth forests from logging would advance the proposal's emphasis on protecting intact, native landscapes. In the proposal, BLM correctly acknowledges that "intact landscapes play a central role in maintaining the resilience of an ecosystem" and "call[s] on authorized officers to prioritize protection of such landscapes."[127] Elsewhere in these comments, we describe the profound climate and biodiversity benefits of mature and old-growth forests. In many situations, the benefits of mature and old-growth forests may be even greater where forest ecosystems remain intact.

Research shows that forests contain more biomass—and thus store more carbon—in their interiors than near their edges.[128] Many species require large areas of contiguous forest to survive and decline or face extinction when intact forest is lost.[129] Forests are also drier along their edges, and areas within intact forests may be less susceptible to natural disturbances including fire.[130] Moreover, intact forests can be more effective at stabilizing the water supply and reducing peak discharge after heavy rainfalls.[131] The discussion of western Oregon forestlands below provides many specific examples of the benefits of intact forests in areas managed by BLM.

As explained elsewhere in these comments, protections for mature and old-growth forests would significantly advance the conservation and mitigation values that the proposed rule rightly

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[125] Merrill, M.D. et al."Federal lands greenhouse emissions and sequestration in the United States: Estimates for 2005-14 – U.S. Geological Survey data release." (2018). https://doi.org/10.5066/F7KH0MK4.

[126] Harris, N.L. et al. "Attribution of net carbon change by disturbance type across forest lands of the conterminous United States." *Carbon Balance and Management* (2016) 11. https://doi.org/10.1186/s13021-016-0066-5.

[127] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,585, 19,590 (Apr. 3, 2023) (proposed rule).

[128] *See* Watson, J.E.M. et al. "The exceptional value of intact forest ecosystems." *Nature Ecology & Evolution* (2018) 2(4): 599–610. http://dx.doi.org/10.1038/s41559-018-0490-x.

[129] *See id.* at 602.

[130] *See id.* at 604.

[131] *See id.* at 602.

recognizes. Many of the benefits of mature and old-growth forests—including benefits for climate, biodiversity, and watersheds—can be even more pronounced when those forests are intact. Protections for mature and old-growth forests are a powerful tool for realizing the public benefits of intact landscapes.

ii. Protection of mature and old-growth on checkerboarded western Oregon BLM forestlands and within younger stands promotes habitat connectivity and ecosystem resilience.

The general checkerboard pattern found on western Oregon BLM forestlands has led to expanses of simplistic early seral forests on intermingled private and public lands (monoculture plantations established after clearcutting MOG forests) adjacent to remaining stands of mature and old-growth on BLM lands, which are clearly identifiable through satellite imagery. Within BLM parcels, extensive logging on public lands has often led to isolated pockets of mature and old-growth forest surrounded by much younger stands. Although the proposed rule emphasizes protection of "intact landscapes,"[132] BLM should not limit such protection only to those areas that strictly meet the proposed rule's rather cramped definition of the term.

The proposed rule defines "intact landscape" to mean "an unfragmented ecosystem that is free of local conditions that could permanently or significantly disrupt, impair, or degrade the landscape's structure or ecosystem resilience, and that is large enough to maintain native biological diversity, including viable populations of wide-ranging species."[133] BLM should consider ecosystem integrity and resilience holistically when considering protection within areas that at first glance do not comport with the proposed rule's notions of "intact" and "unfragmented."

Forests on the western Oregon BLM lands naturally consist of a dynamic mosaic of different seral stages, from preforest (early seral) that occurs following stand-replacing disturbance events, which is then followed by the young forest stage. Over time, if left to grow, these forests evolve into complex late-successional/old-growth stages where legacy trees have survived for over a century and contain multi-layered and relatively closed canopies, standing dead trees, and large amounts of down woody debris. Many species, including the northern spotted owl, depend on this mosaic of habitat types for different essential behaviors, nesting and roosting in mature and old-growth stands, foraging in more open stands, and dispersing across a wider variety of habitat. Where the natural dynamism of these forest ecosystems has been artificially altered by human management through logging and wildfire suppression, protecting mature and old-growth stands that remain on public lands becomes even more important to maintain native biological diversity.

The BLM lands in western Oregon encompass relatively low-elevation forests with correspondingly high potential ecological productivity. These lands offer functional connectivity for mature and old-growth-dependent species across the Willamette Valley and between higher-elevation areas, such as the Cascade, Klamath, and Coast Range Mountains. While species that rely on preforest tend to be more opportunistic habitat generalists and likely evolved to take

[132] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,590 (Apr. 3, 2023) (proposed rule).
[133] *Id.* at 19,598.

advantage of shifting conditions, species that depend on mature and old-growth stands require a greater level of habitat permanency for their essential behaviors. Although their checkerboarded and heavily-managed nature might initially appear contrary to the proposed rule's definition of "intact" to mean "unfragmented," forests naturally contain a variety of seral stages such that, as a whole, the intermingled public and private lands and remaining mature and old-growth stands within them play a vital role in the ecosystem resilience of the overarching biome. Further, protecting stands of mature and old-growth forest on the BLM western Oregon forestlands will promote native species' persistence and recovery as they return to available habitat across the landscape.

Mature and old-growth stands are also more resilient than younger forests to disturbance events and can serve as vital fire refugia,[134] further emphasizing the need for their protection as the climate becomes hotter and drier, and wildfire risk, severity, and frequency increases. Maintaining blocks of resilient mature and old-growth forests on western Oregon BLM forestlands lands will help ensure that key habitat, natural watershed functions, and stored carbon remain on the overall landscape following wildfires.

Although the western Oregon BLM forestlands offer the starkest example of the checkerboard nature of public lands managed by BLM, other areas containing pinyon-juniper and other forest types may also be intermingled with state and private lands.[135] In such areas, the agency should also examine the ecosystems they encompass holistically, recognizing natural levels of dynamism before deeming federal parcels incompatible with the protection of intact landscapes. In many instances, of course, protecting mature and old-growth stands on federal lands within checkerboard ownership is even more important due to the relative scarcity of such habitat and carbon storage opportunities on surrounding private or state lands.

D. Protecting MOG Is Consistent with BLM's Proposed Definition of "Unnecessary or Undue Degradation."

FLPMA requires BLM to prevent unnecessary or undue degradation ("UUD") of the public lands it manages.[136] In the context of proposed "Part 6100 - Ecosystem Resilience," the rule defines "unnecessary or undue degradation" as "harm to land resources or values that is not needed to accomplish a use's goals or is excessive or disproportionate."[137] The proposed rule uses the term UUD two additional times in Part

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[134] Lesmeister, D.B. et al. "Mixed-severity wildfire and habitat of an old-forest obligate." *Ecosphere* (2019) 10(4). https://doi.org/10.1002/ecs2.2696.

[135] For example, BLM manages extensive checkerboarded parcels along the Interstate 80 corridor in Wyoming. *See* Bureau of Land Management, Wyoming Land Status Map (2020), available at https://www.blm.gov/sites/default/files/documents/files/LandStatus_Statewide_500k_2020.pdf (last visited June 13, 2023); *see also* Bureau of Land Management, Western Oregon Plan Revision (WOPR) Planning Area Map (2005), available at https://static1.squarespace.com/static/573a143a746fb9ea3f1376e5/t/5741f3665f21e0f3cad8cd57/1350996385063/OWesternORBLM8x11.pdf (last visited June 12, 2023) (showing checkerboarded and intermingled BLM lands in western Oregon).

[136] 43 U.S.C. § 1732(b).

[137] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,599 (Apr. 3, 2023) (proposed rule).

6100. First, the proposed rule lists the "prevention of unnecessary or undue degradation" as one of five overarching ecosystem resilience principles that BLM must implement in its decision-making.[138] Second, the proposed rule again lists the prevention of UUD as a factor BLM must consider when identifying priority landscapes for restoration.[139]

Logging MOG is, in some ways, the quintessential example of unnecessary or undue degradation. Many uses of the public lands—including logging—can be accomplished without destruction or degradation of essential MOG resources. As noted above, western Oregon forestlands contain over 1,000,000 acres of less-than-mature forest that BLM has deemed available for logging.[140] Logging MOG is not needed to furnish a timber supply from BLM forestlands. In addition, protecting MOG on BLM forestlands would not significantly impact the nation's wood supply. In FY 2022, the Bureau of Land Management offered for sale the equivalent of 55 million cubic feet of wood.[141] In CY 2017 (the most recent year available), wood consumption in the United States totaled 14,851 million cubic feet.[142] The current total wood production from BLM forestlands is 0.4% of total U.S. consumption.

Other suppliers can easily fill any slack from the loss of BLM MOG timber to the nation's wood supply. But no one can replace the biological diversity and watershed integrity lost if BLM's mature and old-growth forests are logged.

III. BLM CAN AND MUST PROTECT MATURE AND OLD-GROWTH FORESTS ON O&C LANDS.

BLM identifies the Federal Land Policy and Management Act of 1976[143] and Omnibus Public Land Management Act of 2009[144] as statutory authority to promulgate the proposed rule.[145] While these statutes provide ample authority for the proposed rule components, elevating conservation—and protecting mature and old-growth forests—is also consistent with and at times compelled by other applicable statutes, including the Oregon and California Railroad

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[138] *Id.*
[139] *Id.* at 19,600.
[140] Bureau of Land Management, Proposed Resource Management Plan/Final Environmental Impact Statement, Western Oregon, Vol. 1 (2016), 310, available at https://eplanning.blm.gov/public_projects/lup/57902/71567/78543/Volume_1_.pdf (last visited June 13, 2023).
[141] Bureau of Land Management. "Public Land Statistics 2021," Table 3-12 (2022) 206: 84–85. https://www.blm.gov/sites/default/files/docs/2022-07/Public_Land_Statistics_2021_508.pdf. Original data in thousand board feet and green tons. Per table footnote, the conversion factors used were 1 MBF = 1.6 CCF = 6 tons.
[142] Howard, J.L. and S. Liang. "U.S. Timber Production, Trade, Consumption and Price Statistics, 1965-2017." *U.S. Forest Service*. Res. Pap. FPL-RP-701. Forest Product Laboratory, Madison, WI (2019). https://doi.org/10.2737/FPL-RP-701. Original data in million cubic feet.
[143] 43 U.S.C. § 1701 *et seq.*
[144] 16 U.S.C. § 7202.
[145] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,598 (Apr. 3, 2023) (proposed rule).

Lands Act of 1937 ("O&C Act"),[146] the Clean Water Act of 1972,[147] and the Endangered Species Act of 1973 ("ESA").[148]

BLM manages the O&C lands pursuant to both FLPMA and the O&C Act.[149] FLPMA broadly instructs BLM to manage public lands for multiple uses "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural conditions," and "that will provide food and habitat for fish and wildlife," as well as outdoor recreation.[150] This congressional direction firmly authorizes BLM to elevate conservation on par with other uses of public lands, including the protection of mature and old-growth forests and trees in their natural conditions.

The O&C Act, meanwhile, specifies that lands covered by the act will be managed for "permanent forest production" on a sustained yield basis "for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities."[151] Although the O&C Act emphasizes sustained yield logging, it also directs BLM to protect watersheds and stream flows, valuable and vital ecosystem services provided by mature and old-growth forests.[152] The O&C Act also does not require every acre of the O&C estate to be devoted to logging, as its language indicates BLM may classify various parcels as "timberlands."[153]

The U.S. Court of Appeals for the Ninth Circuit recently considered whether BLM could manage certain O&C lands for purposes other than commercial logging and determined that, indeed, the agency possessed such discretion under the relevant statutory scheme.[154] Not only does BLM have discretion to designate which areas are "timberlands," the O&C Act requires the lands to also provide non-timber outputs.[155] The Ninth Circuit has repeatedly upheld the agency's discretion to manage for multiple uses, including wildlife habitat protection.[156] As the court

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[146] 43 U.S.C. § 2601.

[147] 33 U.S.C. § 1251 *et seq.*

[148] 16 U.S.C. § 1531 *et seq.*

[149] *See generally Klamath-Siskiyou Wildlands Ctr. v. Bureau of Land Mgmt.*, No. 1:19-cv-1810-CL, 2021 WL 5356969, at *1 (D. Or. Aug. 24, 2021).

[150] 43 U.S.C. § 1701(a)(7)-(8). Under FLPMA, "multiple use" includes, but is not limited to, "recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific, and historical values." *Id.* § 1702(c).

[151] 43 U.S.C. § 2601.

[152] *See* Hammond, H. Submission to Old-Growth Strategic Review (2020), available at https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/old-growth-forests/written-submissions/128_herb-hammond.pdf (last visited June 14, 2023); *see also* Perry, T.D. and J.A. Jones. "Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA." *Ecohydrology* (2017) 10(2): 1–13. https://doi.org/10.1002/eco.1790.

[153] 43 U.S.C. § 2601; *see also Murphy Co. v. Biden*, 65 F.4th 1122, 1134 (9th Cir. 2023).

[154] *Murphy Co.*, 65 F.4th at 1135.

[155] 43 U.S.C. § 2601.

[156] *Murphy Co.*, 65 F.4th at 1135; *Portland Audubon Soc'y v. Babbitt*, 998 F.2d 705, 709 (9th Cir. 1993); *Seattle Audubon Soc'y v. Lyons*, 871 F. Supp. 1291, 1314 (W.D. Wash. 1994) ("BLM's "management decision made here

recently summarized, its previous "decisions reinforce our conclusion that the O&C Act's plain text envisions economic, recreational, and environmental uses for the O&C Lands beyond logging and grants the Department significant discretion in how to achieve statutory compliance."[157]

Consistent with the O&C Act's statutory mandate to protect watersheds and regulate stream flows,[158] the Clean Water Act also offers support for the protection of mature and old-growth forests on western Oregon BLM lands. The agency already recognizes that it must coordinate with the Environmental Protection Agency and the Oregon Department of Environmental Quality to ensure that management of the O&C lands complies with water quality standards and other requirements of the Clean Water Act.[159] Protection of mature and old-growth stands helps accomplish this by naturally filtering run-off and shading streams to maintain cool, clean streams that support aquatic species and downstream water supplies.

BLM has also recognized its duties under the ESA to consult with U.S. Fish and Wildlife Service and the National Marine Fisheries Service on its actions pertaining to O&C lands.[160] It follows that BLM should acknowledge that congressional direction in the ESA offers statutory support for the protection of mature and old-growth forests,[161] including, but not limited to, those found on O&C lands. The ESA affirmatively requires all federal agencies to "utilize their authorities in furtherance of the purposes of [the ESA] by carrying out programs for the conservation of endangered species and threatened species listed pursuant to [the statute]."[162] The ESA defines "conservation" to mean "the use of all methods and procedures which are necessary to bring any [listed] species to the point at which the measures provided pursuant to [the ESA] are no longer necessary."[163] Furthermore, federal agencies must ensure that any actions they authorize do not jeopardize the continued existence of listed species or destroy or adversely modify critical habitat for listed species.[164]

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in regard to the [O&C] lands was a lawful exercise of the Secretary's discretion."), *aff'd sub nom. Seattle Audubon Soc'y v. Moseley*, 80 F.3d 1401, 1406 (9th Cir. 1996).

[157] *Murphy Co.*, 65 F.4th at 1135. Although D.C. District Court Judge Leon did not reach a similar conclusion regarding the breadth of BLM's discretion regarding management of the O&C lands, that decision has been fully briefed and argued on appeal to the D.C. Circuit and awaits the panel's opinion. *See Am. Forest Res. Council v. Hammond*, 422 F. Supp. 3d 184, 191 (D.D.C. 2019); *Am. Forest Res. Council v. United States*, No. 20-5008 (consolidated) (D.C. Cir.).

[158] 43 U.S.C. § 2601.

[159] Bureau of Land Management, Proposed Resource Management Plan/Final Environmental Impact Statement, Western Oregon, Vol. 2 (2016), 1051, available at https://eplanning.blm.gov/public_projects/lup/57902/71567/78543/Volume_1_.pdf (last visited June 13, 2023).

[160] *Id.* at 1049–51.

[161] Section 6103.1(a)(4) of the proposed rule identifies "significant progress" toward restoration or maintenance of habitat for ESA-listed species as a "fundamental of land health" with which standards and guidelines in land use plans must be consistent. Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,59 (Apr. 3, 2023) (proposed rule).

[162] 16 U.S.C. § 1536(a)(1).

[163] *Id.* § 1532(3).

[164] *Id.* § 1536(a)(2).

BLM forestlands, including O&C lands, often overlay habitat—and designated *critical* habitat—for several listed species, including northern spotted owls, marbled murrelets, and several types of salmon and steelhead. Courts have stated that agencies "must in fact carry out a program to conserve" listed species, and cannot rely on an "'insignificant' measure that does not, or is not reasonably likely to, conserve endangered or threatened species."[165] The only measure that will or is reasonably likely to conserve listed species dependent on mature and old-growth forests is to protect their essential habitat from logging. Protecting mature and old-growth forests on O&C lands is necessary not only to avoid jeopardy and adverse modification, but also to comply with BLM's affirmative obligation to help conserve and recover their populations.[166]

IV. WE SUPPORT THE PROPOSED RULE'S EMPHASIS ON THE NEED TO INCORPORATE TRIBAL CONSULTATION AND INDIGENOUS KNOWLEDGE, BOTH IN GENERAL AND WITH REGARD TO MOG PROTECTIONS.

We fully support BLM's commitment to engagement with Tribes and incorporation of Traditional Knowledge as part of this rulemaking process. We hope that a high level of meaningful and supported engagement with Tribal Nations continues throughout this process and in the implementation of any rules that result. Many Tribal Nations have extensive experience managing MOG for natural values that the agency should take particular heed of. Relevant to forest conservation, the Affiliated Tribes of Northwest Indians and the National Congress of American Indians last year adopted resolutions requesting that the Department of Agriculture and Department of the Interior soon initiate a rulemaking process to conserve mature and old-growth forests and trees on ancestral land managed by the U.S. Forest Service and BLM.[167] Both resolutions urged protecting mature and old-growth federal forests and trees from avoidable logging, subject to limited exceptions. And both called for rules that respect traditional and customary uses, incorporate Traditional Knowledge, continue meaningful and supported collaboration with Tribal Nations, and do not infringe on Treaty rights. We urge the agency to respect these resolutions and follow through on its commitment to continued collaboration with Tribal Nations.

V. PROTECTING MOG WOULD FURTHER THE BIDEN ADMINISTRATION'S CONSERVATION PROGRESS.

BLM is correct that "[t]he proposed rule responds to[] and advances directives set forth in several Executive and Secretary's Orders and related policies and strategies."[168] And in order to

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[165] *Fla. Key Deer v. Paulison*, 522 F.3d 1133, 1147 (11th Cir. 2008) (citing *Pyramid Lake Paiute Tribe v. U.S. Dep't of Navy*, 898 F.2d 1410, 1418 (9th Cir. 1990)).

[166] In *Am. Forest Res. Council v. Hammond*, D.C. District Court Judge Leon also held that BLM did *not* have discretion to limit logging on O&C lands in order to comply with Section 7 of the ESA, but that decision is on appeal. *See* 422 F. Supp. 3d 184, 191 (D.D.C. 2019); *Am. Forest Res. Council v. United States*, No. 20-5008 (consolidated) (D.C. Cir.).

[167] Affiliated Tribes of Northwest Indians, Res. #2022-36 (2022); National Congress of American Indians, Res. #SAC-22-012 (2022).

[168] Bureau of Land Management. Conservation and Landscape Health, 88 Fed. Reg. 19,583, 19,587 (Apr. 3, 2023) (proposed rule).

respond to the Administration's MOG and climate policy directives in a meaningful and durable way across BLM's forestlands, the agency must pursue substantive protections for mature and old-growth trees and forests.

Executive Order 14072

President Biden's Executive Order 14072, "Strengthening the Nation's Forests, Communities, and Local Economies," establishes an immediately effective, ongoing policy to "conserve America's mature and old-growth Forests on Federal lands" and to "manage forests on Federal lands, which include many mature and old-growth forests," for purposes including "retain[ing] and enhanc[ing] carbon storage" and "conserv[ing] biodiversity."[169] The Order directed BLM and the U.S. Forest Service to "complete an inventory of old-growth and mature forests on Federal lands" and "develop policies, with robust opportunity for public comment, to institutionalize climate-smart management and conservation strategies that address threats to mature and old-growth forests on Federal lands."[170] BLM and USFS recently completed the inventory.[171]

Although BLM could have proceeded with substantive protections even while the inventory was ongoing, the completion of the inventory means that the Bureau's next step is clear: institutionalizing "strategies that address threats to mature and old-growth forests on Federal lands." A rule that protects mature and old-growth forests from logging is an impactful, immediately available, and necessary path that would bring lasting benefits for our climate and ecosystems.

Executive Order 14008

President Biden's Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," recognizes that the United States has

> a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action.[172]

A rule to protect mature and old-growth forests and trees from logging would significantly advance the directives in Executive Order 14008. In this "narrow moment to pursue action," the U.S. must fully utilize natural climate solutions. Mature and old-growth forests and trees store—and continue to sequester—vast quantities of carbon, making them an essential climate mitigation tool. They also support climate resilience by safeguarding watersheds, regulating

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[169] Exec. Order No. 14,072, 87 Fed. Reg. 24,851, 24,851–52 (April 22, 2022).
[170] *Id.* at 24,852.
[171] U.S. Forest Service and Bureau of Land Management. *Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and Bureau of Land Management: Fulfillment of Executive Order 14072, Section 2(b)*. (2023). FS-1215a. https://www.fs.usda.gov/sites/default/files/mature-and-old-growth-forests-tech.pdf.
[172] Exec. Order No. 14,008, 86 Fed. Reg. 7619, 7619 (Jan. 27, 2021).

weather patterns, and serving as climate refugia. The threat of climate change is too grave and pressing for the U.S. to degrade such an important resource on federal lands.

Protecting mature and old-growth forests and trees will also bolster the Executive Order's objective of strengthening U.S. climate leadership abroad. Carbon-rich forests are under threat around the world. U.S. leadership and credibility are vital when working with other nations to protect their forests. Protections for mature and old-growth forests at home would serve as a powerful model for similar actions around the world.

Greenhouse gas reduction goal

Pursuant to the Paris Agreement, President Biden has set a target for the U.S. to reduce economy-wide net greenhouse gas emissions by 50-52% from 2005 levels by 2030. In listing the policies that will support this goal, the Administration stated, "The United States can reduce emissions from forests and agriculture and enhance carbon sinks through a range of programs and measures including nature-based solutions for ecosystems ranging from our forests and agricultural soils to our rivers and coasts."[173] Notably, mitigating carbon emissions from logging mature and old-growth forests and trees would move the country closer to this goal, alongside (but not as an alternative to) shifting away from fossil fuels in the United States and globally.

Recent analysis indicates that the U.S. is not currently on track to meet its 2030 goal.[174] Meeting the target and avoiding the most catastrophic impacts of climate change will require leveraging a wide array of emission-reduction opportunities. A rule protecting mature and old-growth forests is a simple, highly effective, and immediately available opportunity to reduce our emissions that the nation cannot fail to implement.

[173] The White House, *Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies* (Apr. 22, 2021), available at https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/ (last visited June 14, 2023).
[174] *See* King, B. et al. *Pathways to Paris: Post-IRA Policy Action to Drive US Decarbonization*, Rhodium Group (Mar. 30, 2023), available at https://rhg.com/research/ira-us-climate-policy-2030/ (last visited June 14, 2023).

APPENDIX: DATA AND CALCULATIONS FOR FIGURES IN MAIN TEXT

Table A1. CNPP Values for USFS Regions (compiled from He et al. & Birdsey et al.)[175]

Region	National Forest	Forest Type	Age of CNPP (years)	CNPP Value (tC Ha-1 yr-1)
1	Beaverhead Deerlodge	Subalpine Fir	40	4.15
		Shade intolerant mixed	50	6.21
		Lodgepole Pine	50	9.22
		Douglas-Fir	30	5.99
		Shade tolerant mixed	55	3.55
	Bitterroot	Subalpine Fir	40	4.15
		Shade intolerant mixed	50	6.10
		Lodgepole Pine	50	9.57
		Douglas-Fir	30	6.42
		Shade tolerant mixed	55	3.76
		Ponderosa pine	120	5.40
	Custer	Ponderosa pine	40	4.16
		Shade intolerant mixed	50	5.95
		Lodgepole Pine	50	8.89
		Douglas-Fir	30	6.70
		Shade tolerant mixed	90	3.04
		Subalpine Fir	40	3.58
	Flathead	Subalpine Fir	40	4.17
		Douglas-Fir	30	5.92
		Lodgepole Pine	50	9.70
		Ponderosa pine	45	5.65
		Shade intolerant mixed	50	5.76
		Shade tolerant mixed	55	4.28
	Gallatin	Subalpine Fir	40	4.38
		Shade intolerant mixed	50	6.17
		Lodgepole Pine	50	9.31
		Douglas-Fir	30	5.86
		Shade tolerant mixed	40	4.18
	Helena	Subalpine Fir	60	3.70

175 Birdsey, R. A. et al. "Assessment of the influence of disturbance, management activities, and environmental factors on carbon stocks of U.S. national forests." USDA Forest Service Gen. Tech. Rep. RMRS-GTR-402 (2019). https://doi.org/10.2737/RMRS-GTR-402; He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26(3). https://doi.org/10.1029/2010GB003942.

		Shade intolerant mixed	50	6.12
		Lodgepole Pine	50	9.44
		Douglas-Fir	30	5.63
		Shade tolerant mixed	55	3.96
		Ponderosa pine	120	5.27
	Idaho Panhandle	Subalpine Fir	40	5.05
		Shade intolerant mixed	50	7.90
		Lodgepole Pine	50	9.79
		Douglas-Fir	35	7.09
		Shade tolerant mixed	55	5.43
		Ponderosa pine	30	6.06
	Kootenai	Subalpine Fir	40	5.03
		Shade intolerant mixed	50	8.12
		Lodgepole Pine	50	9.70
		Douglas-Fir	30	6.38
		Shade tolerant mixed	55	4.72
	Lewis and Clark	Subalpine Fir	40	4.58
		Shade intolerant mixed	50	6.21
		Douglas-Fir	30	6.74
		Lodgepole Pine	50	9.57
		Shade tolerant mixed	55	4.00
		Ponderosa pine	120	5.55
	Lolo	Subalpine Fir	40	4.63
		Shade intolerant mixed	50	6.75
		Lodgepole Pine	50	9.51
		Ponderosa pine	30	5.97
		Douglas-Fir	30	6.60
		Shade tolerant mixed	55	4.55
2	Arapaho/Roosevelt	Fir/spruce/mt. Hemlock	60	4.96
		Lodgepole Pine	50	9.19
	Bighorn/Medicine Bow Routt/Shoshone/Arapaho	Douglas-Fir	30	5.54
	Bighorn/Shoshone	Fir/spruce/mt. Hemlock	60	4.63
		Lodgepole Pine	50	9.17
	Bighorn/Medicine Bow Routt/Shoshone/Arapaho/Black Hills	Ponderosa pine	120	5.28
		Aspen/Birch	65	5.83
	Bighorn/Shoshone/Medicine Bow Routt/Arapaho/Roosevelt	Other western softwoods	120	5.68
	Bighorn	Elm/ash/cottonwood	50	5.43

	Grand Mesa/Uncompahgre/Gunnison	Fir/spruce/mt. Hemlock	60	4.56
		Lodgepole Pine	50	9.08
		Aspen/Birch	60	5.24
	Medicine Bow Routt	Fir/spruce/mt. Hemlock	60	4.67
		Lodgepole Pine	50	9.52
	Pike/San Isabel	Fir/spruce/mt. Hemlock	60	4.29
		Lodgepole Pine	50	9.49
		Ponderosa pine	120	5.44
		Aspen/Birch	50	6.59
	Pike/San Isabel/White River	Douglas-Fir	30	5.80
	Rio Grande/San Juan/Pike/San Isabel	Fir/spruce/mt. Hemlock	60	4.85
		Other western softwoods	120	5.86
	Rio Grande	Aspen/Birch	60	6.39
		Douglas-Fir	30	6.82
	San Juan	Aspen/Birch	80	5.93
		Fir/spruce/mt. Hemlock	60	4.77
		Pinyon/Juniper	120	5.64
		Ponderosa pine	30	5.67
	White River	Fir/spruce/mt. Hemlock	60	4.62
		Lodgepole Pine	50	9.53
		Aspen/Birch	85	5.82
3	Apache-Sitgreaves	Pinyon/Juniper	120	5.55
		Ponderosa pine	120	5.38
		Western oak	125	5.22
	Apache-Sitgreaves/Gila/Tonto/Coronado	Douglas-Fir	50	6.23
	All Region 3 forests (20.6 mill acres)	Fir/spruce/mt. Hemlock	60	4.64
		Aspen/Birch	60	6.25
		Other western softwoods	30	5.89
	Carson	Pinyon/Juniper	120	5.70
	Carson/SantaFe	Ponderosa pine	120	5.47
		Western oak	25	6.28
		Douglas-Fir	30	5.76
	Santa Fe	Pinyon/Juniper	120	5.81
	Cibola	Pinyon/Juniper	120	5.62
		Ponderosa pine	30	5.87
	Coconino	Pinyon/Juniper	120	5.57
	Coronado	Pinyon/Juniper	30	5.20
		Western oak	45	5.03

	Gila	Pinyon/Juniper	30	5.42
	Gila/Coronado/Lincoln	Ponderosa pine	120	5.38
	Lincoln	Pinyon/Juniper	120	5.57
	Cibola/Lincoln	Douglas-Fir	35	6.27
		Western oak	125	6.07
	Kaibab	Pinyon/Juniper	120	5.68
		Ponderosa pine	120	5.55
	Prescott	Pinyon/Juniper	120	5.43
	Tonto	Pinyon/Juniper	120	5.61
	Tonto/Prescott/Coconino	Ponderosa pine	120	5.35
4	Dixie	Pinyon/Juniper	75	7.72
		Fir/spruce/mt. Hemlock	40	4.14
	Ashley/Uinta-Wasatch-Cache/Caribou-Targhee	Pinyon/Juniper	120	5.39
	Fishlake	Pinyon/Juniper	120	5.21
	Manti-La Sal	Pinyon/Juniper	120	5.28
	Ashley/Uinta-Wasatch-Cache/Dixie/Fishlake/Manti-La Sal	Douglas-Fir	30	6.18
	Ashley/Dixie/Fishlake/Manti-La Sal	Ponderosa pine	30	5.29
	Fishlake/Manti-La Sal/Humboldt-Toiyabe	Fir/spruce/mt. Hemlock	40	4.39
	Uinta-Wasatch-Cache	Fir/spruce/mt. Hemlock	40	4.01
		Lodgepole Pine	50	9.25
	Ashley	Fir/spruce/mt. Hemlock	30	4.33
		Lodgepole Pine	50	9.27
	Ashley/Uinta-Wasatch-Cache/Dixie/Fishlake/Manti-La Sal/Caribou-Targhee	Other western softwoods	125	6.43
	Ashley/Uinta-Wasatch-Cache	Aspen/Birch	60	5.09
		Woodland hardwoods	15	6.73
	Dixie/Fishlake/Manti-La Sal	Aspen/Birch	60	5.21
		Woodland hardwoods	15	6.60
	Caribou-Targhee/Bridger-Teton	Douglas-Fir	35	6.16
		Fir/spruce/mt. Hemlock	70	4.28
		Lodgepole Pine	50	10.04
		Aspen/Birch	50	5.58
	Salmon-Challis	Fir/spruce/mt. Hemlock	60	4.26
	Payette/Boise	Douglas-Fir	30	6.15
		Lodgepole Pine	50	9.44

		Fir/spruce/mt. Hemlock	60	4.52
	Sawtooth	Douglas-Fir	35	6.14
		Fir/spruce/mt. Hemlock	60	4.42
	Salmon-Challis/Payette/Boise	Ponderosa pine	30	6.01
	Salmon-Challis/Sawtooth	Lodgepole Pine	50	9.32
	Salmon-Challis/Sawtooth/Boise/Payette/Humboldt-Toiyabe	Other western softwoods	25	6.61
		Aspen/Birch	60	5.20
		Pinyon/Juniper	120	5.53
		Woodland hardwoods	125	5.38
5	Angeles	Pinyon/Juniper	30	5.69
		Ponderosa pine	30	6.11
		Fir/spruce/mt. Hemlock	70	6.26
		Lodgepole Pine	50	9.92
		California mixed conifer	40	7.83
		Western oak	25	7.34
		Other western softwoods	25	7.47
	El Dorado	California mixed conifer	40	9.57
	Klamath	California mixed conifer	65	8.09
	Lassen	Ponderosa pine	25	7.95
		Fir/spruce/mt. Hemlock	60	5.95
		Lodgepole Pine	50	10.04
		California mixed conifer	125	6.74
		Western oak	125	6.14
		Other western softwoods	25	6.68
		Western white pine	50	10.71
	Mendocino	Douglas-Fir	35	10.89
		Ponderosa pine	30	7.69
		Fir/spruce/mt. Hemlock	30	6.45
		Other western softwoods	65	6.63
		California mixed conifer	40	8.39
		Western oak	45	7.41
	Plumas	California mixed conifer	40	9.02
	Sequoia	Pinyon/Juniper	120	5.76
		Ponderosa pine	45	6.01

		Fir/spruce/mt. Hemlock	120	8.16
		Lodgepole Pine	50	9.86
		California mixed conifer	25	9.98
		Western oak	125	5.95
	Shasta-Trinity	California mixed conifer	65	7.98
		Western oak	125	6.72
	Sierra	Other western softwoods	25	7.40
		California mixed conifer	65	8.54
		Western oak	45	6.99
	Six Rivers	California mixed conifer	40	9.96
	Tahoe	California mixed conifer	70	8.87
6	Deschutes	Ponderosa pine	30	5.85
		Lodgepole Pine	50	9.58
	Fremont-Winema	Ponderosa pine	30	5.95
		Lodgepole Pine	50	9.55
	Deschutes/Fremont-Winema	Fir/spruce/mt. Hemlock	60	4.58
	Deschutes/Fremont-Winema/Okanogan-Wenatchee	Other western softwoods	30	5.38
	Deschutes/Fremont-Winema/Umpqua	Douglas-Fir	40	9.31
	Colville	Douglas-Fir	30	7.89
	Wallowa-Whitman	Douglas-Fir	35	6.30
		Ponderosa pine	120	5.65
		Fir/spruce/mt. Hemlock	40	4.48
	Malheur/Umatilla/Ochoco	Douglas-Fir	35	6.54
	Malheur/Ochoco	Fir/spruce/mt. Hemlock	40	4.58
	Umatilla/Colville	Fir/spruce/mt. Hemlock	40	5.45
		Ponderosa pine	120	5.72
	Malheur/Colville/Umatilla/Ochoco/Wallowa-Whitman	Hemlock/Sitka spruce	55	5.63
		Lodgepole Pine	50	9.70
		Other western softwoods	120	5.50
	Ochoco	Ponderosa pine	120	5.56
	Malheur	Ponderosa pine	120	5.58
	Mt. Hood	Fir/spruce/mt. Hemlock	40	7.38
		Douglas-Fir	40	9.54
		Ponderosa pine	30	6.31

	Mt. Baker-Snoqualmie	Douglas-Fir	35	11.55
		Fir/spruce/mt. Hemlock	40	7.34
		Hemlock/Sitka spruce	40	9.10
	Okanogan-Wenatchee	Douglas-Fir	35	7.18
		Fir/spruce/mt. Hemlock	60	4.55
		Lodgepole Pine	50	9.57
	Mt. Baker-Snoqualmie/Okanogan-Wenatchee	Western Larch	35	7.42
		Alder/maple	30	8.55
	Rogue River-Siskiyou	Douglas-Fir	40	9.90
		Ponderosa pine	30	8.55
	Rogue River-Siskiyou/Siuslaw/Olympic	Fir/spruce/mt. Hemlock	40	6.63
		Hemlock/Sitka spruce	30	9.81
		Tanoak/laurel	35	10.43
	Olympic	Douglas-Fir	30	14.19
	Siuslaw	Douglas-Fir	35	13.89
	Willamette	Douglas-Fir	40	10.15
	Willamette/Umpqua	Fir/spruce/mt. Hemlock	40	5.59
	Willamette/Umpqua/Gifford Pinchot/Mt. Hood/Okanogan-Wenatchee/Rogue River-Siskiyou/Deschutes	Hemlock/Sitka spruce	40	8.00
	Willamette/Mt. Hood/Gifford Pinchot/Umpqua/Rogue River-Siskiyou	Lodgepole Pine	55	10.97

[Appendix continues on next page.]

Table A2. State average CNPP age values for BLM lands based on table A1.

BLM Region	States	Avg CNPP
1	ID/WY/ND	49
2	MT/CO/SD	68
3	NM	78
4	NV/UT/ID/MT	59
5	CA	56
6	WA/OR	50

[Appendix continues on next page.]

Table A3. EVALIDator FIA query of total carbon (short tons) on BLM lands by forest type

FOREST TYPE	STAND AGE 20 YR CLASSES (0 TO 500 PLUS)	ESTIMATE (total carbon in short tons)	VARIANCE	PLOT COUNT	SE	SE_PERCENT
Douglas-fir	0-20 years	2422866.127	1.12685E+12	14	1061531	43.81300943
Oregon white oak	0-20 years	150420.4204	41816725248	1	204491.4	135.9465565
Canyon live oak	0-20 years	159159.4414	30715689397	2	175258.9	110.1153155
Tanoak	0-20 years	843700.1002	3.61236E+11	3	601029.3	71.23731041
Pacific madrone	0-20 years	162583.5964	35878905878	1	189417.3	116.5045453
Nonstocked	0-20 years	3589088.152	8.88669E+11	21	942692.2	26.26550605
Douglas-fir	21-40 years	43757143.26	2.61443E+13	105	5113149	11.68528961
Noble fir	21-40 years	408701.3043	1.34083E+11	2	366173.1	89.59431783
Pacific silver fir	21-40 years	60483.92063	5629150961	1	75027.67	124.0456425
Lodgepole pine	21-40 years	1171214.825	3.64468E+11	4	603712.2	51.54581181
Western hemlock	21-40 years	383417.935	2.26208E+11	1	475613.2	124.0456425
Western redcedar	21-40 years	379403.583	2.21496E+11	1	470633.6	124.0456425
Red alder	21-40 years	1073141.235	4.14047E+11	9	643465	59.96088548
Bigleaf maple	21-40 years	743586.952	4.03923E+11	2	635549.7	85.47079742
California black oak	21-40 years	101269.3816	31590474524	1	177737.1	175.5092122
Canyon live oak	21-40 years	618589.4602	3.09222E+11	2	556077.2	89.89439294
Tanoak	21-40 years	184311.6826	43668284154	1	208969.6	113.3783677
Pacific madrone	21-40 years	1486677.712	6.7387E+11	5	820896.1	55.21681776
Douglas-fir	41-60 years	44485148.8	3.62189E+13	85	6018218	13.52860008
Port-Orford-cedar	41-60 years	56582.13872	4926310077	1	70187.68	124.0456425
Incense-cedar	41-60 years	237657.0393	76663228272	1	276881.3	116.5045453
Sugar pine	41-60 years	144828.0876	38765198749	1	196888.8	135.9465565
Jeffrey pine	41-60 years	111303.6145	11304259150	1	106321.5	95.5238427
White fir	41-60 years	131091.8973	23325847745	1	152728	116.5045453
Grand fir	41-60 years	1020361.094	1.05441E+12	2	1026846	100.6355764
Lodgepole pine	41-60 years	697624.9423	2.36104E+11	3	485905.4	69.65137927
Western hemlock	41-60 years	1292229.086	1.28304E+12	3	1132715	87.65591834
Red alder	41-60 years	1536088.987	9.75005E+11	5	987423.3	64.28164531
Bigleaf maple	41-60 years	519904.589	2.63653E+11	2	513471.1	98.76256928

Oregon white oak	41-60 years	1147988.267	4.35142E+11	4	659653.2	57.46166723
Canyon live oak	41-60 years	482578.5487	1.67783E+11	2	409613.2	84.88011829
Tanoak	41-60 years	723262.1287	6.72437E+11	1	820022.8	113.3783677
Pacific madrone	41-60 years	1244653.365	6.421E+11	3	801311.2	64.38026758
Douglas-fir	61-80 years	42229257	4.1993E+13	68	6480203	15.34529364
Pacific silver fir	61-80 years	636799.0258	6.23976E+11	1	789921.4	124.0456425
Grand fir	61-80 years	293601.305	1.32039E+11	1	363371.7	123.7636526
Lodgepole pine	61-80 years	558623.8873	1.85914E+11	2	431177.7	77.18568487
Western hemlock	61-80 years	797714.7222	4.12361E+11	2	642153.7	80.49916184
Red alder	61-80 years	1325086.244	8.18219E+11	3	904554.5	68.26382416
Bigleaf maple	61-80 years	1417071.416	1.57236E+12	2	1253939	88.4880283
Oregon white oak	61-80 years	942686.6754	3.06709E+11	4	553813.5	58.74841504
Canyon live oak	61-80 years	579011.2697	5.13523E+11	1	716605.5	123.7636526
Tanoak	61-80 years	61217.37336	5766501494	1	75937.48	124.0456425
Giant chinkapin	61-80 years	887847.5551	5.65318E+11	2	751876.5	84.68531533
Pacific madrone	61-80 years	1923715.94	1.43192E+12	4	1196628	62.20400856
Douglas-fir	81-100 years	32393301.76	3.7283E+13	49	6105984	18.84952784
White fir	81-100 years	2826954.222	3.5992E+12	4	1897155	67.10949851
Red fir	81-100 years	761429.8178	8.88068E+11	1	942373.4	123.7636526
Pacific silver fir	81-100 years	2031.82546	6323521.977	1	2514.661	123.7636526
Lodgepole pine	81-100 years	205374.604	32574414164	1	180483.8	87.8803075
Western hemlock	81-100 years	603498.2298	3.36723E+11	2	580278.7	96.1525094
Red alder	81-100 years	66199.1375	6743225577	1	82117.15	124.0456425
California black oak	81-100 years	1129328.369	9.1491E+11	2	956509.4	84.69719475
Oregon white oak	81-100 years	1675278.035	5.97847E+11	7	773205.8	46.15388016
Canyon live oak	81-100 years	1392047.703	9.32122E+11	4	965464.9	69.35573169
Tanoak	81-100 years	471923.2935	3.42693E+11	1	585400.3	124.0456425
Giant chinkapin	81-100 years	768877.9202	9.09657E+11	1	953759.6	124.0456425
Pacific madrone	81-100 years	2426746.952	1.58551E+12	6	1259170	51.88717493
Douglas-fir	100-120 years	27199812.27	3.22048E+13	41	5674923	20.86383317
Incense-cedar	100-120 years	184922.6297	44423832344	2	210769.6	113.9771912

Sugar pine	100-120 years	969530.4424	6.78216E+11	2	823538.5	84.94199844
Jeffrey pine	100-120 years	96568.08588	12657647147	1	112506.2	116.5045453
White fir	100-120 years	619801.6553	3.85822E+11	2	621145.8	100.216868
Grand fir	100-120 years	663730.2086	6.74791E+11	1	821456.7	123.7636526
Western hemlock	100-120 years	59216.16279	3092494554	1	55610.2	93.91051238
Western redcedar	100-120 years	831126.4106	1.06291E+12	1	1030976	124.0456425
Red alder	100-120 years	692.2573994	737391.6898	1	858.7151	124.0456425
California black oak	100-120 years	373680.149	1.79498E+11	1	423672.5	113.3783677
Canyon live oak	100-120 years	538008.7274	4.45391E+11	1	667376.4	124.0456425
Tanoak	100-120 years	661759.1018	6.70789E+11	1	819017.2	123.7636526
Pacific madrone	100-120 years	1758898.01	1.30318E+12	4	1141568	64.90247813
Douglas-fir	121-140 years	31577694.56	4.04604E+13	41	6360849	20.14348857
Jeffrey pine	121-140 years	250505.7258	1.15977E+11	1	340553.9	135.9465565
White fir	121-140 years	2024467.298	1.46531E+12	4	1210502	59.79358575
Western hemlock	121-140 years	1234104.176	1.43849E+12	2	1199371	97.18554112
Red alder	121-140 years	126779.5378	24732120533	1	157264.5	124.0456425
Oregon white oak	121-140 years	628025.0979	2.07526E+11	3	455550.2	72.53694076
Tanoak	121-140 years	851982.0968	9.85251E+11	1	992597.9	116.5045453
Pacific madrone	121-140 years	1774.772881	4824716.553	1	2196.524	123.7636526
Douglas-fir	141-160 years	10977110.7	1.33453E+13	20	3653123	33.27945732
Sugar pine	141-160 years	575649.9423	5.09894E+11	1	714068.7	124.0456425
White fir	141-160 years	819915.3197	1.03443E+12	1	1017069	124.0456425
Pacific silver fir	141-160 years	1023645.376	1.60504E+12	1	1266901	123.7636526
Western hemlock	141-160 years	861717.3631	1.1426E+12	1	1068923	124.0456425
Western redcedar	141-160 years	1412317.975	1.5594E+12	1	1248760	88.4191803
Canyon live oak	141-160 years	806186.0217	5.32256E+11	2	729559	90.49511953
Tanoak	141-160 years	726379.3147	8.08189E+11	1	898993.6	123.7636526
Douglas-fir	161-180 years	12778714.63	1.71279E+13	18	4138591	32.38660232
White fir	161-180 years	1038372.702	1.04703E+12	2	1023246	98.54322861
Canyon live oak	161-180 years	303632.3306	1.1851E+11	1	344253.4	113.3783677
Douglas-fir	181-200 years	4930521.795	6.3717E+12	6	2524222	51.19583533
White fir	181-200 years	1013698.753	1.58118E+12	1	1257449	124.0456425
Western hemlock	181-200 years	42292.59787	2739775401	1	52342.86	123.7636526
Douglas-fir	200-220 years	10944528.36	1.52138E+13	15	3900491	35.63873252
Douglas-fir	221-240 years	7524772.186	1.1416E+13	7	3378762	44.90184489

Canyon live oak	221-240 years	244840.1567	92241917734	1	303713.5	124.0456425
Douglas-fir	241-260 years	10475985.1	1.47548E+13	12	3841200	36.66671468
Western hemlock	241-260 years	947616.7061	1.38175E+12	1	1175477	124.0456425
Douglas-fir	261-280 years	4108385.265	5.82252E+12	5	2412990	58.73329107
Tanoak	261-280 years	772327.3752	7.66767E+11	1	875652.2	113.3783677
Douglas-fir	281-300 years	4165047.138	4.80314E+12	5	2191607	52.61902283
Canyon live oak	281-300 years	506078.7835	3.29228E+11	1	573783.9	113.3783677
Douglas-fir	300-320 years	5061519.589	7.39694E+12	6	2719731	53.7334954
Douglas-fir	321-340 years	900660.7976	1.2482E+12	1	1117230	124.0456425
Douglas-fir	341-360 years	4868490.178	9.11703E+12	4	3019443	62.02010243
Douglas-fir	361-380 years	3336935.296	6.03254E+12	3	2456124	73.60418207
Douglas-fir	381-400 years	1724093.679	2.43746E+12	2	1561237	90.55409208
Douglas-fir	400-420 years	948223.8433	1.1558E+12	1	1075081	113.3783677
Douglas-fir	421-440 years	71548.76752	7877117797	1	88753.13	124.0456425
Western hemlock	441-460 years	640959.8976	6.32157E+11	1	795082.8	124.0456425
Douglas-fir	500+ years	1397866.104	3.00673E+12	1	1733992	124.0456425
California black oak	Not available	201042.4784	51956042012	1	227938.7	113.3783677
Oregon white oak	Not available	534014.5669	1.70063E+11	4	412387.3	77.22398883
Tanoak	Not available	435755.0096	2.57733E+11	1	507674.4	116.5045453

[Appendix continues on next page.]

Table A4. Total carbon breakdown by age class for western Oregon BLM lands (from table A3)

Stand Age	Total Carbon (mill. short tons)	Standard Deviation
0-20	7.33	1.58
21-40	50.37	5.38
41-60	53.83	6.49
61-80	51.65	6.97
81-100	44.72	6.89
101-160	87.86	10.14
161-200	20.11	5.12
201-300	39.69	7.39
301-400	15.89	5.12
401-500	1.66	1.34
500+	1.40	1.73
n/a	1.17	0.69

Table A5. Calculations from FIA queries for western Oregon BLM land statistics.

Region	Total Carbon (mill. short tons)	% W OR	Total Area (acres)	% W OR
Western Oregon (BLM)	375.68		2321105.77	
All BLM lands	1320.17	28.46		
All public lands	18007.16	2.09	250702984.84	0.93

[Appendix continues on next page.]

Table A6. Total carbon on BLM forestlands vs. forest type (queried from FIA)

FOREST TYPE	TOTAL CARBON (short tons)	SE	TOTAL CARBON (mill. short tons)	SE
Pinyon / juniper woodland	392002090.5	6448335.142	392.0020905	6.448335
Douglas-fir	379730546	12178618.65	379.730546	12.17862
Juniper woodland	106685254.5	3794015.911	106.6852545	3.794016
Western juniper	83970861.77	4503022.063	83.97086177	4.503022
Nonstocked	50825567.41	2691185.413	50.82556741	2.691185
Ponderosa pine	32219851.16	3122413.006	32.21985116	3.122413
Mesquite woodland	29050238.54	2124993.739	29.05023854	2.124994
Deciduous oak woodland	24803960.31	2074112.193	24.80396031	2.074112
Rocky Mountain juniper	23821884.92	2024290.806	23.82188492	2.024291
Aspen	20669610.12	2568121.671	20.66961012	2.568122
Cercocarpus (mountain brush) woodland	18061345.7	1926255.926	18.0613457	1.926256
Canyon live oak	13606548.92	2642674.639	13.60654892	2.642675
White fir	12201600.8	3235848.832	12.2016008	3.235849
Lodgepole pine	10541885	1771056.679	10.541885	1.771057
Pacific madrone	9841237.555	2443004.286	9.841237555	2.443004
Tanoak	9411291.908	2691337.717	9.411291908	2.691338
Subalpine fir	9013589.461	1885459.477	9.013589461	1.885459
California mixed conifer	8082032.28	2531809.697	8.08203228	2.53181
Engelmann spruce	7988059.98	2069267.588	7.98805998	2.069268
Western hemlock	7721637.628	2683610.714	7.721637628	2.683611
Oregon white oak	7617738.121	1536833.271	7.617738121	1.536833
Red alder	5157006.131	1636803.026	5.157006131	1.636803
Grand fir	4699084.154	1923926.108	4.699084154	1.923926
Interior live oak	4424085.724	1151532.769	4.424085724	1.151533
Engelmann spruce / subalpine fir	3461286.84	1179296.73	3.46128684	1.179297
Limber pine	3450874.79	986735.0801	3.45087479	0.986735
Western redcedar	3264394.826	1746412.765	3.264394826	1.746413
California black oak	3017957.77	1242653.066	3.01795777	1.242653
Bigleaf maple	2680562.957	1496642.215	2.680562957	1.496642
Mountain hemlock	2462367.373	1331230.364	2.462367373	1.33123
Cottonwood	2310869.401	953550.0386	2.310869401	0.95355
Blue oak	1734706.783	626976.5754	1.734706783	0.626977
Pacific silver fir	1722960.147	1496858.424	1.722960147	1.496858
Sugar pine	1690008.472	1106592.604	1.690008472	1.106593
Giant chinkapin	1656725.475	1212792.058	1.656725475	1.212792
California laurel	1537165.383	1280588.806	1.537165383	1.280589
Intermountain maple woodland	1525774.731	683165.5431	1.525774731	0.683166
Blue spruce	1422094.952	639772.8192	1.422094952	0.639773

Other hardwoods	1397618.114	548264.6721	1.397618114	0.548265
Evergreen oak woodland	1331185.843	555221.2565	1.331185843	0.555221
Jeffrey pine	1193634.294	579233.2466	1.193634294	0.579233
Gray pine	1179434.126	553147.3804	1.179434126	0.553147
White spruce	1133969.614	689535.524	1.133969614	0.689536
Miscellaneous western softwoods	899079.0883	513857.1966	0.899079088	0.513857
Whitebark pine	894280.2613	483622.8515	0.894280261	0.483623
Black spruce	841036.0907	596230.3278	0.841036091	0.59623
Foxtail pine / bristlecone pine	824904.6001	548731.878	0.8249046	0.548732
Red fir	761429.8178	942373.3544	0.761429818	0.942373
Paper birch	696651.028	495843.4029	0.696651028	0.495843
Western larch	575219.8792	423673.6332	0.575219879	0.423674
Eastern redcedar	434186.992	343701.8144	0.434186992	0.343702
Incense-cedar	422579.669	347382.198	0.422579669	0.347382
Loblolly pine	420953.7812	426287.0457	0.420953781	0.426287
Noble fir	408701.3043	366173.1455	0.408701304	0.366173
White oak / red oak / hickory	382381.0828	363823.9131	0.382381083	0.363824
Red maple / lowland	373590.6171	366600.6822	0.373590617	0.366601
Bur oak	328481.84	358722.3362	0.32848184	0.358722
Knobcone pine	322645.0627	152462.4324	0.322645063	0.152462
Sugarberry / hackberry / elm / green ash	297433.7958	203945.9076	0.297433796	0.203946
Coulter pine	240324.2435	241706.4923	0.240324244	0.241706
Jack pine	200752.2788	191902.1217	0.200752279	0.191902
Miscellaneous woodland hardwoods	188750.0307	192999.8882	0.188750031	0.193
Balsam poplar	109540.4516	109855.5181	0.109540452	0.109856
Cottonwood / willow	84959.46074	85133.55125	0.084959461	0.085134
Black locust	63864.75014	63686.32875	0.06386475	0.063686
Port-Orford-cedar	56582.13872	70187.67753	0.056582139	0.070188
Oregon ash	24375.82587	22879.11145	0.024375826	0.022879

[Appendix continues on next page.]

Table A7. Total carbon vs. stand age class for pinyon pine and juniper forest types/woodlands (queried from FIA).

FOREST TYPE	STAND AGE 20 YR CLASSES	Total Carbon (mill. short tons)
Juniper woodland	0-20	0.667629026
	21-40	1.172240752
	41-60	2.552514764
	61-80	8.999822432
	81-100	14.41400442
	101-120	10.30295282
	121-140	12.93960828
	141-160	11.58558055
	161-180	7.756458125
	181-200	9.00794151
	200+	25.36307525
	Not available	1.92342657
Pinyon / juniper woodland	0-20	4.051474096
	21-40	3.817574563
	41-60	9.357839268
	61-80	20.1526562
	81-100	31.95790051
	101-120	36.10784868
	121-140	43.25136593
	141-160	43.85226467
	161-180	45.8574187
	181-200	39.96323934

	200+	108.7020486
	Not available	4.930459971
Rocky Mountain juniper	0-20	1.545894105
	21-40	1.367192348
	41-60	1.909250579
	61-80	4.175730913
	81-100	4.970472018
	101-120	2.796472037
	121-140	2.336633389
	141-160	1.389562705
	161-180	1.528715057
	181-200	0.723654282
	200+	1.078307487
Western juniper	0-20	0.637075049
	21-40	1.058729235
	41-60	7.559583155
	61-80	16.54789613
	81-100	17.31715676
	101-120	11.13507278
	121-140	5.16922408
	141-160	6.450381377
	161-180	1.077808907
	181-200	1.796356847
	200+	12.81127653
	Not available	2.410300917

Table A8. Total carbon by age class for all BLM forestlands queried from FIA using EVALIDator.

FOREST TYPE	STAND AGE 10 YR CLASSES	ESTIMATE (total carbon in million short tons)	SE
Total	0-10 years	72.31823799	3.358001789
Total	11-20 years	34.71995975	2.720841658
Total	21-30 years	35.78111341	3.654758824
Total	31-40 years	45.28870222	4.875606102
Total	41-50 years	40.67128698	4.915771168
Total	51-60 years	48.63739673	5.362456356
Total	61-70 years	60.10080069	5.8202211
Total	71-80 years	75.75001345	6.249305469
Total	81-90 years	82.9347592	6.362152854
Total	91-100 years	73.59447725	6.009956476
Total	101-110 years	76.70598949	6.347917675
Total	111-120 years	58.15076876	4.907313438
Total	121-130 years	65.28751962	6.095000677
Total	131-140 years	62.53484875	5.564552168
Total	141-150 years	53.7538027	4.82605451
Total	151-160 years	45.54520921	4.300412568
Total	161-170 years	41.54148111	4.056292543
Total	171-180 years	39.01872821	3.996694294
Total	181-190 years	39.11335459	4.388827552
Total	191-200 years	27.92936672	2.57937297
Total	200+ years	220.554862	10.4358277
Total	Not available	20.24062568	2.271309471