Juniper Group Sierra Club
c/o Environmental Center
16 NW Kansas Avenue
Bend, OR 97703

6 September 2023

To:
Jennifer Abernathy
NEPA Planner
Ochoco National Forest
3160 NE 3rd Street
Prineville, OR 97754

Regarding: Mill Creek Dry Forest Restoration Project, Draft Environmental Assessment, https://www.fs.usda.gov/project/?project=58081

Jennifer Abernathy and Ochoco National Forest:

The Juniper Group Sierra Club, representing over 2000 members in Eastern Oregon counties, is responding to the Ochoco National Forest (ONF) request for comments on Mill Creek Dry Forest Restoration Project, Draft Environmental Assessment (DEA).

First we want to thank you and Elizabeth Peer for the many years of work you and others have put into this report. We are impressed with the quality of this DEA and how well it documents and supports the position and actions the ONF is proposing.

Given the limit of 30 days we have to respond and our limited resources for research and writing, our response will first provide some comments regarding overall impressions of the project and end with some specific recommendations for improvements.

Topics

Overall Criticisms

Using Wilderness to Dilute Data

The Mill Creek Wilderness is excluded from any actions on this project by Federal law as it is designated a Wilderness Area, and thus it must be excluded from inclusion as part of this project area. As used in this DEA, this wilderness area of 13205 acres is 36% of the total project area of 36430 acres. This effectively dilutes any analysis by including area that cannot be acted upon, an area that is mandated to be managed differently from the rest of the project area.

For example, when calculating measures such as road density, wilderness dilutes values calculated when by law it cannot have roads. That is, actual road density for the area in which roads are permitted is actually higher than reported in the DEA.

While this is pointed out in the Purpose and Need statement on page 1 of the DEA, it is also stated that private inholdings of 130 acres are not included in project area calculations. This discrepancy in how these land designations are handled is persnickety. An honest accounting would exclude both private inholdings and wilderness as both areas are outside the scope of any action by this project.

HRV Goal Improper

The continued use of Historic Range of Variability (HRV) as a management goal by ONF continues to frustrate us and others who understand the long-standing science that shows how inappropriate this is. Not only are the measures provided for HRV from the ONF 1994 draft report *Viable Ecosystems Management Guide* [44] derived from weak data,[1] but more importantly, this historic data does not fit with how climate is driving changes to forest vegetation and how to best manage for future conditions.

The Purpose and Need states, as is done in most ONF projects, that the project aims to restore forest conditions to those calculated for the HRV. This 30 year old concept has been discounted by the majority of researchers and the best available science, if only because of the current radically changing conditions on this planet. For just one example, see this USDA reference: https://srs.fs.usda.gov/pubs/47361 ([32]). The ONF must instead of looking back, look forward to protect large, old trees and encourage ecosystems that will dominate the conditions we will see in the next 100 years. In most cases this is no action, letting natural processes adapt the biota to the changing conditions.

The use of HRV for management decisions was first promoted in the 1990's, about the same time ONF Draft report [44] was written. In 2009, Keane *et. al.* [18] (another USDA reference) pointed out weaknesses and pitfalls in using HRV while still holding it as a possible aid, with limitations. The authors do state (p. 1034):

> To use HRV in an operational context, it must be assumed that the record of historical conditions more or less reflects the range of possible conditions for future landscapes; an assumption that we now know is overly simplistic because of documented climate change, exotic introductions, and human land use.

And (p. 1035):

> If expected biotic responses to climate change come true, tomorrow's landscapes will be so altered by human actions that current management philosophies and policies of managing for healthy ecosystems, wilderness conditions, or historical analogs will no longer be feasible because these objectives will be impossible to achieve in the future.

Many other scientists concur with this analysis of HRV usage in forest management. For example, see: *Trees in Trouble,* by Daniel Mathews [27]; *The Treeline,* by Ben Rawlence [40]; and Nonaka, *et. al.* [35].

1 The discussion on HRV in this comment is somewhat truncated, as it has been presented before to the FS and has not received an adequate rebuttal. A more complete presentation that includes the weak data aspect is here https://bit.ly/3OUn55F, and includes references to more peer-reviewed papers.

HRV is being used in the DEA only for the range of tree species, tree density, and forest structure. It does not address the forest ecosystem processes that are all important to forest resilience. Resilience is very dependent upon biodiversity and the interactions of a multitude of plants and animals. The HRV and goals of this DEA focus mostly on creating a monoculture of Ponderosa pine. Other natural processes to consider are natural plant succession and the interactions of flora and fauna, along with geologic conditions of each site and microsite. Accurate management and control of nature is unlikely.

The ONF must look at the future range of variability as the management goal, and determine how it is different than the historic range of variability. In other words, anthropogenic climate change has resulted in a different range of future possibilities relative to the past. The historic range of variability may be a useful point of reference, but it is an unattainable goal. We suggest that the agency needs to tolerate more dense stands, as occurs in natural plant succession, while maintaining enough variability so that disturbances are controlled by discontinuities, then make sure that post-disturbance landscapes retain structural legacies and are allowed to recover their complexity.

For HRV the DEA uses a draft report from 1994 [44] that does not incorporate the most up to date science and includes the omitted data in Baker, *et. al.'s* analysis [3] on the proper HRV model to use in dry, Western forests—the mixed-severity model. In the Project area, the DEA is rooted in the assumption that historic forest conditions were homogeneous, as it states: "Stands of large trees (mainly ponderosa pine) with an open 'park-like' nature were abundant historically, being maintained by frequent low intensity fires in most of the PAGs."[2] The Project appears to be using the low severity HRV model, which is rooted in incomplete data. At the very least, the difference in models for HRV is a scientific controversy that should be addressed and explained, and the updated methodologies described in Baker *et. al.* [3] must be addressed. The impacts of an out-of-date model for HRV would have significant consequences for the design and analysis of the Project, as estimations for logging to restore HRV and account for fire behavior would all be overstated in the analysis.

We again note that our forests will continue to be altered by a warming planet, and the forest ecosystems will naturally adapt and change. Further human intervention and manipulation to mimic forest structures under a past climate regime—one that no longer exists and will not exist in any near future—is ill advised. Many report that global warming warrants new approaches to ecosystem restoration. (For example, [42].) We need to emphasize the "assumed" part of the following statement in the DEA on page 21:

> "While HRV is not a perfect metric for forest resilience through future climatic changes it does focus on what is assumed to be a more sustainable range of conditions across a landscape"

Ongoing scientific analysis repeatedly shows this is an incorrect assumption. This attempt to create a landscape "modeled on known historic conditions" (DEA, p. 21) fails to account for likely future conditions. Even a researcher frequently used by the Forest Service has made the use of HRV a conditional, limited tool ([16], p. 10):

> "Our thinning simulations are designed to inform managers about the effects of thinning at very broad spatial scales. Individual silvicultural prescriptions that consider site specific conditions and other management objectives will be necessary to meet stand-scale restoration objectives."

2 Mill Creek Vegetation Report, page 10

The reference in the DEA to the use of HRV by the Eastside Screens (DEA, pp. 5, 22) is presented as if it supports such use in this DEA. Yet even in the 1994 Eastside Screens there was controversy over this new (at that time) theory for forest management. From the 5 June 1995 Decision Notice [25]:

> "Concern about the adequacy and propriety of the Historic Range of variability (HRV) process and the rigidity of the complete deferral of timber activities in the riparian areas existed before and after the adoption of the 1994 interim direction."

Considering that such debates have existed since its inception, it is fair for us to question the use of the draft 1994 document [44] by ONF for deciding HRV conditions to direct treatments for management objectives "regarding density, structure, and composition" (DEA, p. 21). The ONF should drop such arguments. After all, if HRV is to be used to return forests to their historic levels, other levels of human intrusion must also be restored, including road density and grazing levels, if this is an honest goal for management.

Fire as a Natural Process

Regarding wildfire, the Sierra Club supports home-hardening and other methods of reducing the risk of property destruction from wildfire, as recommended in the article "5 Ways to Protect Your Home from Wildfires" in Sierra Magazine [28] and as promoted by the NFPA Firewise program [34]. The film *Elemental* also supports these recommendations, and in addition finds that "Thinning and burning in vegetation within a 1/4 mile of homes and communities can help create operable space for firefighters in favorable conditions."([15], FAQ page) We must all acknowledge that "favorable conditions" do not always exist, especially in these times of climate chaos, and the fuel reduction (thinning) treatments practiced by ONF will not always be effective. We also understand that thinning outside of WUI often promotes wildfire spread by increased drying of fuels (by wind and solar radiation), increases wind dispersal of fire, increased growth of ground vegetation fuels, and increased access by humans who cause fire ignitions. (For example: [10])

We are concerned with how the ongoing restoration and fuels-reduction by ONF is creating a tree plantation-like setting that has greatly reduced natural forest characteristics. Natural ecosystem cycles that include nutrient and carbon cycling from deadwood decay to soil formation to the growth of large trees are modified by this constant disturbance. This affects insect, bird, reptile, and mammal populations, as well as floral and fungal species. The removal of small trees for biomass (DEA, p. 12) is an economic benefit but also removes nutrients from the ecosystem, and increases water depletion of the ecosystem by removing wood, standing and downed, that holds moisture, slows the wind, and blocks the solar radiation that dries the soil. Organic matter contributed to the soil by downed wood also helps retain moisture, build soil, and slow water runoff. Important decay organisms at the bottom of the food chain are also limited by removing wood, and thus limit the numbers and complexity of species higher on the food chain. We would choose less disruptive efforts that allow natural processes, including wildfire, to rejuvenate our public forest ecosystems and all the benefits they provide, including clean air and clean water.

The natural carbon cycle that has developed over the eons allows for biomass accumulation, soil creation, plant succession, and a complex food chain, along with carbon sequestration and healthy biodiversity. This cycle is disrupted in unnatural ways by the interventions proposed in this project.

This work is a poor approximation of the natural fire cycles and the ecological processes of a healthy forest, and fails to live up to the adjective “restoration”. This project must account for how it disrupts ecological systems, wildlife habitat, and biodiversity in ways that natural disturbances do not.

For example, a study by Bradley, *et. al.*, [7] found that less management resulted in lower severity fires. As stated by Maloof [26]:

> “[it is often]...espoused that forests must be managed to be healthy. Perhaps forests must be managed to get the healthiest economic return, but true biological health is found in the unmanaged old-growth forests.”

Many other studies question the approach taken by the Forest Service (FS) overall which is reflected by the ONF on this DEA. For example, one study ([3]) questions the FS analysis of fire history[3]; another points to the effect of climate on fire behavior ([37]). Given the past 100 years of mis-management of forests (fire-suppression, etc.) that has resulted in the current condition (DEA p. 6 and others), and the ongoing debate about appropriate forest and fire management, we believe less management is the appropriate course of action.

Resource Extraction or Long-Term Health

The ONF is a multi-use forest, but has put a priority on resource extraction, as stated on page 3 of the DEA, to “supply timber and wood products”. National and world priorities have shifted to give conservation and climate change an equal and we hope a priority stand to be considered against such short-term economic uses. In response to Executive Order 140721 [4], the ONF needs to consider carbon sequestration and full ecosystem long-term health, changing from short-sighted local economic goals to long-term national goals and generation-spanning ecosystem processes.

Cumulative Effects Analysis Incomplete

The cumulative effects analysis in this DEA is limited to the “spatial boundary ... of the project area” (p. 22). The justification for this is that this boundary “is of a scale sufficient to encompass historic disturbance regimes” (p. 22). This justification is not adequate given the current landscape disturbance regimes across the whole forest that are cause by the ONF, the timber industry, and other human activities. The cumulative effects analysis needs to not only look at other projects within this project area, but at adjoining projects outside the Mill Creek watershed that also affect migration routes, riparian disturbances, wildlife disturbance, and human activities.

If cumulative effects are not looked at outside of the “spatial boundary” of the project area, is it not logical to also ignore the WUI extent across this boundary?

The DEA implies that the ONF is under pressure to meet a quota for timber harvesting (p. 238). This project should detail this quota, and describe how much of this quota is expected to be met in this project area. The cumulative effects of attempting to meet any quota across the whole forest need to be considered by each project.

3 Discussion of this study is available at: https://www.youtube.com/watch?v=U-rB2SvLSPg

Human activity has been increasing over time both within the Mill Creek project area and throughout the ONF. This leads the ONF to consider projects such as Lemon Gulch, road improvements, and trail expansions. Increased road traffic, camping, and hunting pressure are all affecting wildlife and the ecosystem, especially when including illegal activities such as firewood and timber harvesting, OHV use off-trail, etc. Forest-wide pressures need to be considered.

The ONF does not exist by itself in the Blue Mountain Ecoregion. Other forests in this region are also seeing increased use and human disturbance, as well as pressure to increase logging and maintain grazing. The Blue Mountains provide a forested migration route for many animals. ONF is part of the Pacific Northwest Region 6 and plays a role in the success of this region to maintain functional ecosystems. While this Mill Creek project may seem like a small piece, the cumulative effects of the many small projects are each a small cut that lead to ecological declines and global warming.

As an example of how the ONF is interconnected across the region and across states, look at this image (Figure 1) scrapped from The Nature Conservancy website about animal migration routes [13]:

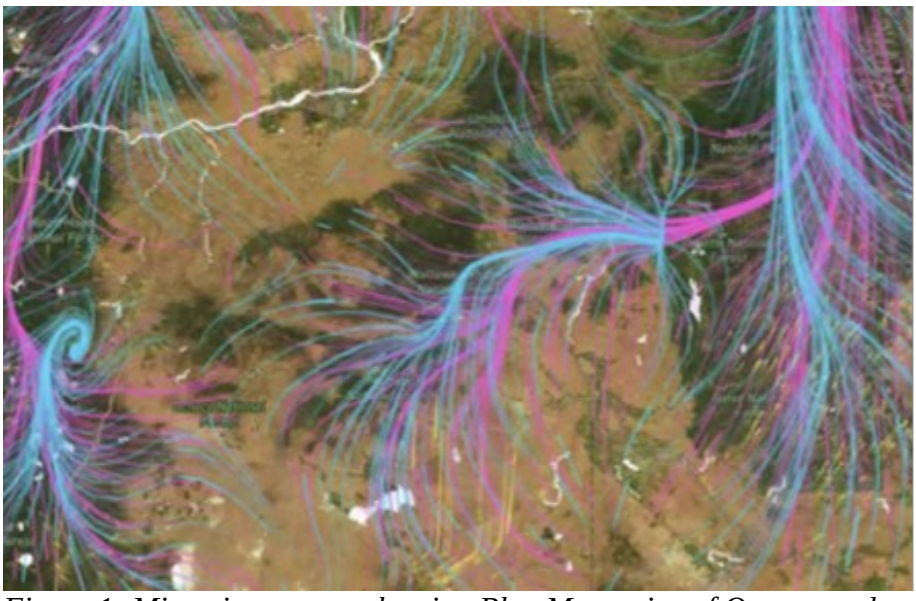

Figure 1: Migration routes, showing Blue Mountains of Oregon and into Idaho

Even though the ONF lacks a modern, updated forest plan, and other efforts have begun to update the Blue Mountain forest plans overall[4], this does not exempt projects like this from looking at the big picture. Cumulative effects extend well beyond the “spacial boundary” of the project. At the minimum, the cumulative effects analysis must look at adjoining watersheds, just over the ridgeline.

Ecosystem Services

An extremely important contribution of the natural forest ecosystem to the local as well as regional and national environment are ecosystem services. These include not only carbon sequestration, but also

4 Blue Mountain Forest Plans: https://www.fs.usda.gov/detail/umatilla/home/?cid=fseprd1066821

purification of air and water, flood control, nutrient cycling, and detoxification of dangerous compounds.[5]

Ecosystem services is minimally addressed in this DEA as an objective to “provide for ecosystem services (e.g., nutrient cycling or water storage)” (p. 156). This is then handled as part of Best Management Practices (BMP), which is discussed in Appendix A, “Resource Protection Measures and Best Management Practices” (p. 271).

This minimizes the important contribution of our local natural forest processes to our clean water and air, flood control, and continued forest health. These contributions extend well beyond to human existence in the region and across the nation. Other nations are doing better, and work with natural processes to improve their environment and lives [38]. We believe the ONF should be putting more emphasis on the co-existence of humans and nature, and less on what humans can extract from the forest. (For example, see: [19], [41], [43])

Specific Areas of Concern

Management Emphasis

The current Ochoco Forest Plan, from 1989, states that the “management emphasis is to produce timber and forage”, and this is carried through to this DEA as given under the Management Direction on page 4. While timber production and grazing are part of a multi-use forest, these activities are of decreased importance with the rise of recreational usage in our national forests. Evidence of this is with the implementation of recreational user fees on the neighboring Deschutes National Forest, and the continued discounted use fees for forage and timber production, increased user visitation in the ONF, and efforts such as Lemon Gulch to add more recreational trails[6].

Timber and forage production also run counter to national and international efforts to counter climate change. Societal needs change over time, as does the importance of timber and forage from the ONF on the international market for these commodities. The greatest benefit to the citizens of this county and this country from the forest is from carbon sequestration and ecosystem services, along with recreational opportunities. Far more people benefit from recreation than from timber and cattle production.

Goal For Ponderosa Pine

We love Ponderosa pine, but the DEA throughout emphasizes creating what seems to be a monoculture of Ponderosa pine in “park-like” condition. While using HRV to justify this condition (which we previously showed is inappropriate), this is describing the conditions seen in a Ponderosa pine plantation. This fits well with this statement from page 4 of the DEA for management direction from the forest plan:

> “In ponderosa pine stands, management will emphasize production of high value (quality) timber.”

5 For more on ecosystem services, see: https://en.wikipedia.org/wiki/Ecosystem_service

6 Lemon Gulch is more of an experience, or recreational area, than a recreational trail.

A plantation condition can be achieved with the quick chainsaw work described in this DEA. However, a natural forest condition cannot be achieved this way. The biodiversity and ecological interactions of such a natural forest develop over time, and retain high biodiversity and spacial variation not seen in a plantation stand.

Harvesting Large Trees

Removing large trees, that is, trees great than 21-inch DBH, runs counter to the needs to:

- protect LOS,
- recruit old growth,
- provide carbon sequestration.
- provide forest health
- provide forest structure and diversity

While such harvesting provides an economic incentive, there is much sound scientific analysis that demonstrates this is bad for the health of the forest and for the ecosystem. It also has a negative effect on most recreational experiences, as demonstrated by standard efforts to provide for viewsheds and buffers to hide evidence of logging. For example, see the section on Scenic Quality starting on DEA page 202, and the desire in Steins Pillar to "maintain natural-appearing forest stands" (DEA p. 21).

Large trees are especially significant for carbon storage and biodiversity. (See [21], [30], [31]) In forests, this means no cutting of any mature or large trees, that is, no cutting trees older than 80 years or larger than 21 inch DBH. Old growth stands must be protected for this reason as well as for the unique ecological value these stands provide. Countering anthropogenic climate change by allowing trees to grow to maturity and into old growth stands is required for long-term sustainability of our public forests' health.

In order to meet climate resiliency, the ONF must participate in the Federal and global efforts to protect 30% of the land by 2030, and 50% by 2050. Without efforts to slow and reverse anthropogenic climate change, timber harvests will fail. Limited, sustainable harvests are achievable, if reasonable levels that allow for increased conservation and protection are created. There are millions of acres of private forest land that are also being harvested to meet societal needs for timber, so using public lands for the greater good is reasonable.

Looking at the big picture, true protection is possible and has already been outlined in a prescription for forest strategic reserves to protect biodiversity and sequester carbon. A team of accomplished scientists published in 2021 [21] a framework and maps that are ready for the FS to apply on western national forests. This message was repeated in the 2022 paper [23], with "preserving 30 to 50% of lands for their carbon, biodiversity and water is feasible, effective, and necessary". This approach to safeguard carbon stocks, protect habitat for threatened animal and plant species, and connect climate corridors for wildlife and plants makes the most sense for climate resilience. The ONF must be part of this solution.

We also note that the Eastside Screen amendment cited in the DEA, "Forest Management Direction for Large Diameter Trees in Eastern Oregon and Southeastern Washington" (2021), which replaced a 21-

inch tree diameter limit, has to date failed the challenge of a lawsuit.[7] We ask the ONF to remove all consideration of harvesting any trees with 21-inch DBH or larger.

Biomass Production

Removing small trees as biomass over 1239 acres is proposed in Alternative 3. This may have some carbon offset aspect if it replaces fossil fuel extraction, but it also has negative effects:

- removes nutrients,
- removes soil building organics,
- removes insect and fungal habitat,
- removes replacement trees for trees harvested for timber,
- destroys forest structure,
- increases surface drying and potential wildfire spread.

It is questionable if a biomass industry will want to commit to the volume available in this project, as businesses want a "guaranteed" annual harvest of biomass. Is the ONF expecting to meet an ongoing demand for woody biomass, and how does this fit into the overall forest plan?

Insects and Disease

While the Forest Service sponsored studies in the section on Insects and Disease, beginning on page 34, identify some potential benefits of thinning treatments, there are other factors to consider when looking at the big picture. As described in *Trees in Trouble* [27] and elsewhere:

- A diversity of tree species slows insect spread.
- Insect populations and diseases have cycles, some years causing more damage than others.
- The disturbance caused by thinning can stress trees that remain and cause more disease and insect damage.
- Trees that remain in root and mycorrhizal connection spread information to help trees counter infestations.
- Insects and disease are part of natural processes.

We question the importance of thinning for insect and disease control.

Steep Slope Logging Destructive

Steep slope logging has long been avoided in order to protect soils from disturbance and compaction and greater erosion. Opening slopes up by removing trees increases drying and wind effects, thus increasing wildfire spread and intensity. Wooded slopes are also good wildlife security areas and add to the diversity of flora and structure in a forest. Not performing steep slope logging must be a continuing practice.

Elk Habitat

The DEA fails to properly locate and analyze the Project's special elk habitat, such as habitat needed for rutting, wallowing and calving, and the negative impacts of the Project on this special habitat.

7 US District Court for the District of Oregon, Pendleton Division, Case No. 2:22-cv-00859-HL, Document 97, Findings and Recommendations, 08/31/23. Available: https://pdf.wildearthguardians.org/support_docs/eastside-screens-08-31-2023-decision-97%20F%20and%20R.pdf

The elk numbers in the Project area are below Oregon Department of Fish and Wildlife's (ODFW) set management levels, and the alternatives should be designed to help increase these numbers. As stated in the DEA, managing healthy, stable elk populations is a cooperative effort between the FS and ODFW, with the FS responsible for the management of habitat, and with explicit direction in the Ochoco Forest Plan for the District to "manage elk and deer habitat to meet the population objectives of the ODFW to the extent practicable."[8]

Further, the DEA inadequately analyzes how current cattle allotments impact special elk habitats, including specific locations for calving and rutting in the Project area. Most of the Project is within the 58,857 acres of the Mill Creek Allotment Management Plan's grazing allotments, and the Wildlife Report addresses that "livestock grazing may be present within portions of the project during rutting season and may impact use of the project area by elk, thus reducing the utility of some wallows.[9] There should be a specific analysis on when and where cattle allotments interact with specific elk calving and rutting sites, as this has a direct impact on elks' ability to effectively use this habitat, and the specifics on how elk are impacted by the Project alternatives.[10]

The DEA also uses an inaccurate analysis scale for its elk security analysis. The DEA states that "Much of the elk security habitat within the Mill Creek project area lies within the Mill Creek Wilderness in the northeastern corner of the watershed."[11] The Mill Creek Wilderness area should be excluded from the elk habitat security analysis as it is not open to treatment and dilutes this analysis.

Riparian Concerns

Riparian areas are or can be some of the most biodiverse areas in the forest, and thus require the most protection from human manipulation. Any activities in these areas should be minimized and approached with critical concerns. Past efforts have been detrimentally affecting riparian areas, and continued efforts are not fairing better.

Like many other western forests, much of the ONF experiences management actions such as the construction of valley bottom roads and intensive timber harvest and livestock grazing. The bulk of the National Forest System roads were built in the last 50 years with most constructed for access to timber harvest, including along streams and in riparian areas. With the depletion of large trees over the past century from high grading timber harvest practices, the remaining large trees in riparian areas are all the more important to retain. Large trees provide a far greater benefit than smaller trees and are critical for forming and retaining high quality pools, last longer than smaller trees, and are more effective at providing instream habitat and reducing bank erosion. When large trees are undercut or die, they provide the large downed wood that is important for creating pools and sheltered areas for fish.

One of the primary goals of amending planning documents (e.g., INFISH, Eastside Screens) in the 1990s was to implement new management practices that would support viable native salmonids ([39], [29]). The primary method to improve stream conditions was to limit activities such as timber harvest, road construction, livestock grazing, and other activities near streams that had caused the degradation

8 Mill Creek Dry Forest Restoration EA, Wildlife Effects Analysis, page 24
9 Mill Creek Dry Forest Restoration EA, Wildlife Effects Analysis, page 30
10 Mill Creek Dry Forest Restoration EA, Wildlife Effects Analysis, page 30 ("In addition, livestock grazing may be present within portions of the project during rutting season and may impact use of the project area by elk, thus reducing the utility of some wallows")
11 Mill Creek Dry Forest Restoration EA, Wildlife Effects Analysis, Appendix E, page xx- Existing Conditions

of streams and riparian areas ([5]). The new policy guidelines were implemented to minimize sediment runoff from roads, conduct watershed scale analysis, identify priority watersheds where aquatic species would have greater protection, and implement stream restoration projects. Concurrent with changes in management policies that were expected to improve streams and riparian areas was a 70% reduction in the quantity of timber harvested from public lands in the Pacific Northwest region ([1]).

Effects on fish habitat from loss of streamside vegetation due to timber harvest, roads, and livestock grazing, include increased stream temperature, loss of cover, increased erosion, a widening and shallowing of the stream channel, and reduction or loss of perennial flow. Degraded habitat is characterized by increased sediment, increased water temperatures, a decline in pool depth, quality, and frequency, reduced large woody material (LWM), increased cutbanks and bank instability, and high width/depth ratios. Detrimental effects on water quantity include primarily flow reduction or loss, temperature, sedimentation, and turbidity, and limits to fish distribution and production ([6]).

Studies have shown that logging, even selective logging, has increased instream fine sediments ([20], [33]) and increased instream water temperatures ([11]) and these changes in habitats are found decades after logging. Most streams on National Forest lands in Eastern Oregon, like the ONF, have high stream temperatures and violate state water quality standards for temperature. These high temperatures are a serious long-term threat to water quality and continue to be a problem due to both past and current land management practices of timber harvest, high road densities and livestock grazing. High stream temperatures, especially in violation of state and Forest Plan stream temperature standards, create chronic and acute lethal conditions for native fish and limit their productivity and survival in areas where they are already stressed by high loads of fine sediments. Even local increases of water temperatures and sediment at the subwatershed or reach scale can cause local extinctions which cannot be recovered ([36]).

Logging in riparian areas can increase nutrient loads, stream temperature, and sediment to the stream, compromising fish habitat and water quality. Any active management in stream corridors and riparian areas risks harm to stream ecosystems ([36]) via the release of nutrients and increases in sediment and stream temperatures.

Roads

The road density values used for this project as reported in the DEA in tables on page 123 are incorrectly calculated because the total project area includes the Mill Creek Wilderness which cannot considered for roads, treatments, or any actions, as it is designated Wilderness. This dilutes road density values and other values by adding 13,205 inactive acres, acres that cannot be part of any alternative action in the project area. The actual road density is more honestly calculated by using active project acres of 23,225.

Roads fragment the landscape and it is imperative that ONF reduce this destructive presence, both legitimate roads and illegal roads. Fragmentation and disturbance occur from both roads and trails, and the cumulative impacts of all such disturbances must be analyzed.

The Project presents the same road network changes in all three alternatives—close 1.86 miles, decommission 3.26 miles, open 0.9 miles, reinforce road closures at 24 locations, and build temporary

roads that create up to 86.23 miles of ground disturbance.[12] These plans are meant to meet the Project's purpose and need to "align road maintenance levels with the travel management plan."

To identify an appropriate road density throughout the forest and the Project area, the ONF must fully scrutinize the Project's roadwork component in accordance with the Travel Management Rule.[13] Specifically, the agency must demonstrate how the Project's roadwork components are consistent with the 2015 Ochoco Travel Analysis Report[14] and the identification of the "minimum road system".[15] There are additional requirements for road densities for Ochoco Forest Plan MA-F20 Winter range and MA-F21 General Forest Winter Range, which are: "Road and trail use will be limited to one mile of open access per section from December 1 to May 1; a greater density of trail and road access will be available during the remainder of the year, up to three miles per section."[16]

To address road system alignment with the travel management plan, the District has done important and meaningful work to identify 24 locations where closed roads remain functionally open, where it will reinforce closures, in addition to closing and decommissioning a small number of roads, and opening a small number of new roads. Missing from the District's approach, though, is a true accounting of all functionally open roads as part of a road density analysis. To ensure compliance with the Ochoco Travel Management Plan and Winter Range road density standards and guidelines, the District must include the milage of functionally open "closed" roads, of all maintenance level roads, and all user created roads, in order to accurately account for road density in the Project area.

Further, the DEA has identified 131.62 miles of Forest Service Roads maintenance level 1-5.[17] In 2021, the Great Old Broads for Wilderness conducted a road survey and found that of the 110 closed roads surveyed, 31 (28%) were closed, 66 (60%) were open and driven, and 13 (12%) were not surveyed. The survey also found numerous decommissioned and user created roads that were driven but did not enumerate those. This was not a comprehensive mapping exercise, which suggests there are numerous additional roads not counted toward the Project's overall density.

Additionally, we remain concerned about the high number of temporary roads needed for this Project under each alternative, and the degree of disturbance from road maintenance, reconstruction, and new construction, as presented in DEA tables 77 and 78.[18] The opening and creation of temporary roads, in addition to disturbing and fragmenting habitat, significantly increases the amount of sediment delivered into streams, which, as the DEA concedes, "could negatively impact the amount and quality of pool habitat in the project area."[19]

12 Draft EA, page 11, Table 2: Summary of Activities in Alternative 2; page 13, Table 3: Summary of Activities in Alternative 3; page 14, Table 4: Summary of Activities in Alternative 4; page 220, Table 77: Miles of temporary road construction proposed for alternatives 1, 2, 3, and 4

13 36 C.F.R. part 212, and Executive Orders 11644, 11989

14 See *Ochoco National Forest & Crooked River National Grassland Forest-wide Travel Analysis Report*, USDA Forest Service 2015, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd968961.pdf

15 See *Travel Management FEIS and ROD*, USDA Forest Service 2015, https://www.fs.usda.gov/detail/ochoco/landmanagement/planning/?cid=stelprd3808312

16 ONF Plan, 4-18

17 Draft EA page 213, Table 72: Current distribution of roads by maintenance level in the project area.

18 Draft EA, page 220, Table 77: Miles of temporary road construction proposed for Alternative 1, 2, 3 and 4., Table 78: Summary comparison of environmental effects to transportation resources.

19 Draft EA, page 180, Table 61: GRAIP-Lite Modeled sediment data for the project area; page 186

Disturbance Ignored

The analysis of Alternative 1 states that it does not include disturbance (p. 24). This is contradicted by statements elsewhere in the DEA that acknowledge that disturbance is commonplace (pp. 27, 33, and others). This lack of analysis results in an invalid comparison of the no action alternative, Alternative 1, to the other alternative. We are left without a true picture of what happens with no action.

The disturbance of the vegetation and land caused by thinning treatments weaken the overall forest structure and increase windfall because trees are not there to support each other. The wind effect on the remaining trees is also increased with fewer trees to break the wind. Mutual support during times of rain and snowmelt which weaken root holding is also reduced.

Treatments also result in mechanical damage to the trees that remain from the movement of heavy equipment and the felling of neighboring trees. Such damage weakens the trees and increases the potential of disease and insect damage.

Undeveloped Area

The undeveloped area analyzed beginning on page 228 should receive no treatment. This area is important for winter range, as noted in the DEA. It is also important security habitat. It also provides a buffer between the developed rural areas and the Wildcat and White Rock campgrounds. Undeveloped areas like this are important moderators of flood waters, slowing meltwater and intense rains, and restoring aquifers.

While the DEA shows the undeveloped area on a map in outline, a topographic map is more informative. Take a look at a comparison (Figure 2 and Figure 3):

Figure 2: Part of undeveloped area map from DEA.

The following map shows the topography of the same area. The yellow blotches are the campgrounds, and the private inholdings are shown on the left, which are white in the map above:

Figure 3: Section of topographic map showing undeveloped area from DEA.

While the precise lay of the boundaries of the undeveloped area on Figure 3 must be visualized, the same will be true in on-the-ground implementation of thinning. What can be seen is that the terrain includes some steep slope areas. As seen when hiking Wildcat Mountain (the peak on the right with the jeep trail to the top), the terrain does have steep sections and is good elk security habitat.

Undeveloped areas continue to come under pressure for development. Part of this can be seen when looking at planning applications[20] along Mill Creek Road. There is no need for ONF to put additional roads in this area for logging, as such intrusions will lead to further disturbance and access both legal and illegal. In fact, the ONF should leave this area untouched, as such areas are more rare and more valuable every year.

Climate Change

The section in the DEA on "Carbon and Climate Change" (p. 231) makes use of adjectives like "infinitesimal" and "negligible" to distance the ONF from responsibility to respond to the national and global efforts to counter anthropogenic climate change. This is blatant disregard for Executive Order 140721 [4]. This is refusal to use the best available science to acknowledge that every effort from every agency and every person can help, or can hurt, the current and future habitability of this planet.[21]

20 Crook County planning applications map: https://geo.co.crook.or.us/portal/apps/experiencebuilder/experience/?id=32afa1591d5c4447927d4c9c6f405dad

21 The ONF seems to be opposing climate science. Can we believe any of the science it does use?

Perhaps ONF should consider that even judicial systems are recognizing the impact of climate change on future generations, with a duty to protect its citizens. [12], [9]

The latter part of the section on climate change presents a Forest Service lead paper [17] that suggests the actions proposed in this project are minimally contributing to climate change, and even uses IPCC guidance "for minimizing the impacts of climate change on forest carbon" (DEA p. 232). We note that "minimizing" is not the same as "preventing". Other research results show that the No Action alternative will be better at sequestering carbon and offsetting anthropogenic climate change (Examples: [8], [14], [30], [31], [45]).

We urge the ONF to use the precautionary principle[22] and to use forestry methods to increase carbon sequestration, rather than look to "minimizing" carbon release which harms both us, the present generation, and future generations.

The DEA also speaks to the Project's ability to aid in carbon dioxide sequestration through timber management by

> "(1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), (3) by manipulating existing forest cover (managed forests), and (4) through transferring carbon from the live biomass to the harvested wood product carbon pool." (DEA p. 232)

The Project, however, does not increase new forests nor avoid damage to the forest. Rather, it is actively participating in removing maturing trees (with up to 15,232 acres of logging and 56.1 MMBF in Alternative 3, p. 12), which contributes to carbon emissions and removes trees from the carbon sink. Additionally, young trees replanted in plantation stands are actually net carbon emitters for up to 20 years. [2], [24] Further, the process of transferring carbon from live biomass to harvest wood products is a massively carbon intensive process. Carbon is lost at every stage—from the harvest itself, the manufacturing of products, the end of the products' use, and decay. Over the past 100 years of logging, 65% of the wood product carbon (not production losses) has returned to the atmosphere, and 16% has been transferred to landfills.[23] The most effective way to actually contribute to carbon sequestration is to preserve trees, not log them. In Eastside forests, 3% of large trees are storing 42% of the forest's above ground carbon. The DEA should give a full accounting of its actual emissions for each alternative, and note any large trees it removes as taking away from this carbon sink.[30]

Specific Recommendations

Overall

This DEA has failed to evaluate a reasonable range of alternatives. NEPA requires the agency's environmental analysis documents to "[r]igorously explore and objectively evaluate all reasonable alternatives"; see 40 C.F.R. § 1502.14(a). [24] We ask the ONF to evaluate alternatives that better consider the health of the forest and the region over the long-term.

We recommend a project alternative that does the following:

22 Precautionary principle: https://en.wikipedia.org/wiki/Precautionary_principle

23 Tara W Hudiburg et al 2019 Environ. Res. Lett. 14 095005; [22]

24 40 C.F.R. § 1502.14(a); Please be explicit about which version of the CEQ's NEPA regulations are being applied. We request that you apply the spirit, if not the letter, of the 1979 version of the regulations, given the legal and regulatory uncertainty surrounding the 2020 version.

- Protects all LOS, and defines areas for the ongoing recruitment of new LOS and new Old Growth.
- Maintains the long-standing rule of not harvesting any trees over 21-inch DBH.
- Manages for more biodiversity for the future condition, as this is the most resilient forest.
- Has no steep slope logging.
- Takes no action on the undeveloped area as identified in the section beginning on p. 228.
- No harvest around the perimeter of the wilderness area.
- An alternative that greatly reduces the scale of treatments across the Project area (Alt 2 and 3 treat 98.96% of the non-wilderness project area, Alt 4 treats 76% of the non-wilderness area) with less of a focus on commercial logging.
- An alternative that greatly reduces commercial and noncommercial logging within RHCAs and introduces more riparian restoration activities.
- More road closures and fewer miles of new road construction (even temporary).

There is no real need to harvest along the narrow perimeter of the wilderness area. Leaving this alone would benefit wildlife by maintaining this habitat. As a similar reduction in activity is proposed around the Steins Pillar area, there is precedence for including such exclusions in an alternative.

There is no real need to harvest in the undeveloped area (DEA p. 228). Leaving this alone would benefit wildlife by eliminating this disturbance and maintain security habitat. It would also provide a nice area to slow flood waters and help restore the aquifer. Undeveloped areas are rare on the ONF, and leaving this area is a great benefit to wildlife.

This DEA needs alternatives that explore ecologically sound options that avoid adverse environmental effects introduced by extensive commercial and non-commercial logging. Reducing the area of treatments will help maintain forest and riparian health in spite of disturbances from increasing recreational usage and ongoing grazing pressures.

The Mill Creek watershed is broken up with private inholdings and well traveled roads. This fragmentation must be reduced by closing roads effectively. We also appreciate that this is one highly used area of the ONF. As such, leaving all the large trees and the intact forest ecosystem that remains would be the best use of this area. This is, after all, what most users of the forest are coming to the forest to experience.

Steep Slope Logging

Steep slope logging has been restricted in all forest projects due to erosion problems, soil compaction, and more. No steep slope logging should be performed. Opening steep slopes by logging also opens them to more intense wildfire. It also eliminates some of the best wildlife habitat remaining, as well as large and old trees. Steep slopes are also prone to more after-logging downfall due to root damage, wind, and surface erosion.

Riparian

Problems with any actions taken in riparian areas are described and documented above, “Riparian Concerns.” We recommend that no actions be taken in riparian areas.

Timber and Forage

Looking to collaborate with other users of our public forest, we need to address the FS directive to provide for the extraction of our public resources, timber and forage. This has been done historically to support these industries from our public lands at discounted rates from what would be seen on private lands. Here we discuss some considerations.

First, the ONF has a directive from higher up in the agency to meet a timber production quota. This information is not provided in this DEA, but it is stated that a goal of 12 MMBF per year should be sustainable, based on historical production levels (p. 238). This is highly doubtful given climate change and the ongoing drought, as well as changing forest uses, and an analysis of what is a reasonable production level needs to be produced and vetted.

Once a timber production quota for the whole ONF is agreed to, the portion of that amount that could reasonably be supplied by the Mill Creek project area, excluding the Mill Creek Wilderness, should be determined. Given an honestly created sustainable level, we could suggest ways to try to achieve that and protect the ecosystem of Mill Creek as well. For example, we suggest evaluation of the following:

- The most logging should be done in the WUI area that is being used.[25] This has the benefit of giving the rural residents of that area a sense of wildfire safety. It also opens more of the WUI to greater forage production, as more sunlight will reach the understory.
- While we would like to have grazing removed from public lands, we acknowledge that this is still one of many uses of this forest. We believe this should change for the greater health of the ecosystem.
- Concentrate grazing on the WUI area and remove it from more remote areas of the forest. This would be beneficial to wildlife and forest health. Concentrating grazing and logging in the WUI reduces transportation costs for these industries and makes management easier for both industries.
- Using the concepts of silvopasture (https://en.wikipedia.org/wiki/Silvopasture) could produce both timber and forage in a sustainable manner, from the WUI area. We acknowledge that such concepts are outside the scope of this DEA, but these should be part of a broader discussion.
- There is a danger that if implemented, some people will want to expand the boundaries of the WUI. This must not be permitted, as undeveloped forest zones are still required for other users and for overall forest and regional health, including ecosystem services.

From this discussion it is obvious that the current forest plan needs to include more concepts that will protect the full forest ecosystem and look at limits to timber and forage production, as well as support changing societal desires for recreation, large tree protections, and ecosystem services. The role of the ONF in national and global needs must also be considered. Timber and forage products exist in an international market, and it is not the responsibility of the ONF to respond to changing markets in order to support these industries. As a multi-use public forest, private industry does not get (should not get) special treatment at the expense of other users and the forest itself.

25 While we disagree with the area designated as WUI in this project, which was crafted by COIC, we are leaving that discussion for another time. We would prefer using a more standard, widely-accepted definition as provided by Schug, *et. al.*, in https://www.nature.com/articles/s41586-023-06320-0

Closing

Overall, we find that the action alternatives presented for this project in this DEA have not adequately looked at long-term forest health, the needs of wildlife, biodiversity, and large-landscape forest management, along with national directives regarding climate change. The driving force for this project appears to be timber harvesting, along with concerns about wildfire. This leaves out other purposes and needs of our public lands, such as ecosystem services and recreation.

We therefore support Alternative 1, no action, until other alternatives can be evaluated.

The Forest Service must manage the public lands of the Ochoco National Forest as a public trust[26], ensuring that a natural, biodiverse forest ecosystem will be functioning for future generations. Will our seventh generation[27] have a forest to enjoy, or will it be a tree plantation? Decisions for Mill Creek and the cumulative effects across the whole forest will help determine that end condition.

Sincerely,

/s/ Mathieu Federspiel
Juniper Group Executive Committee
http://bit.ly/junipergrouphome
Bend, Oregon
mathieuf.sc@gmail.com

26 Public trust doctrine: https://en.wikipedia.org/wiki/Public_trust_doctrine
27 Seven generation sustainability: https://en.wikipedia.org/wiki/Seven_generation_sustainability

References

[1] Adams, Darius M., Richard W. Haynes, and Adam J. Daigneault. 2006. “Estimated Timber Harvest by U.S. Region and Ownership, 1950-2002.” PNW-GTR-659. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. https://doi.org/10.2737/PNW-GTR-659.

[2] Amiro, B. D., A. G. Barr, J. G. Barr, T. A. Black, R. Bracho, M. Brown, J. Chen, et al. 2010. “Ecosystem Carbon Dioxide Fluxes after Disturbance in Forests of North America.” *Journal of Geophysical Research* 115 (October): G00K02. https://doi.org/10.1029/2010JG001390.

[3] Baker, William L., Chad T. Hanson, Mark A. Williams, and Dominick A. DellaSala. 2023. “Countering Omitted Evidence of Variable Historical Forests and Fire Regime in Western USA Dry Forests: The Low-Severity-Fire Model Rejected.” *Fire* 6 (4): 146. https://doi.org/10.3390/fire6040146.

[4] Biden, Joe. 2022. *Strengthening the Nation’s Forests, Communities, and Local Economies*. https://www.govinfo.gov/content/pkg/FR-2022-04-27/pdf/2022-09138.pdf.

[5] Boisjolie, Brett A., Mary V. Santelmann, Rebecca L. Flitcroft, and Sally L. Duncan. 2017. “Legal Ecotones: A Comparative Analysis of Riparian Policy Protection in the Oregon Coast Range, USA.” *Journal of Environmental Management* 197 (July): 206–20. https://doi.org/10.1016/j.jenvman.2017.03.075.

[6] Bottom, D.L., P.J. Howell, and J.D. Rodgers. 1985. “The Effects of Stream Alterations on Salmon and Trout Habitat in Oregon.” Oregon Department of Fish and Wildlife. https://ir.library.oregonstate.edu/downloads/n009w297w.

[7] Bradley, Curtis M., Chad T. Hanson, and Dominick A. DellaSala. 2016. “Does Increased Forest Protection Correspond to Higher Fire Severity in Frequent-fire Forests of the Western United States?” *Ecosphere* 7 (10). https://doi.org/10.1002/ecs2.1492.

[8] Christenson, Norm, and Jerry Franklin. 2023. “New Trees Are No Substitute for Old Trees.” *Politico*, June 11, 2023. https://www.politico.com/news/magazine/2023/06/11/to-fight-wildfire-our-forests-need-to-grow-old-00101360.

[9] Corder, Mike. 2019. “Activists Cheer Victory in Landmark Dutch Climate Case.” December 20, 2019. https://apnews.com/article/5534fe18ac5352ba43c74c9a64d6a20a.

[10] DellaSala, Dominick A., Bryant C. Baker, Chad T. Hanson, Luke Ruediger, and William Baker. 2022. “Have Western USA Fire Suppression and Megafire Active Management Approaches Become a Contemporary Sisyphus?” *Biological Conservation* 268 (April): 109499. https://doi.org/10.1016/j.biocon.2022.109499.

[11] Guenther, S. M., T. Gomi, and R. D. Moore. 2014. “Stream and Bed Temperature Variability in a Coastal Headwater Catchment: Influences of Surface-Subsurface Interactions and Partial-Retention Forest Harvesting: STREAM AND BED TEMPERATURES IN A COASTAL

HEADWATER CATCHMENT.” *Hydrological Processes* 28 (3): 1238–49. https://doi.org/10.1002/hyp.9673.

[12] Hanson, Amy Beth, and Matthew Brown. 2023. “Judge Sides with Young Activists in First-of-Its-Kind Climate Change Trial in Montana.” August 14, 2023. https://www.opb.org/article/2023/08/14/judge-sides-with-young-activists-in-first-of-its-kind-climate-change-trial-in-montana/.

[13] Hausheer, Justine E. 2023. “Migration in Motion: Visualizing Species Movements Due to Climate Change.” February 6, 2023. https://blog.nature.org/2016/08/19/migration-in-motion-visualizing-species-movements-due-to-climate-change/.

[14] Hudiburg, Tara, Beverly Law, David P. Turner, John Campbell, Dan Donato, and Maureen Duane. 2009. “Carbon Dynamics of Oregon and Northern California Forests and Potential Land-Based Carbon Storage.” *Ecological Applications* 19 (1): 163–80. https://doi.org/10.1890/07-2006.1.

[15] Jennings, Trip, dir. 2022. *Elemental: Reimagine Wildfire*. Documentary. https://www.elementalfilm.com.

[16] Johnston, James D., Skye M. Greenler, Becky A. Miller, Matthew J. Reilly, Amanda A. Lindsay, and Christopher J. Dunn. 2021. “Diameter Limits Impede Restoration of Historical Conditions in Dry Mixed-conifer Forests of Eastern Oregon, USA.” *Ecosphere* 12 (3). https://doi.org/10.1002/ecs2.3394.

[17] Joyce, L. A., S.W. Running, D. D. Breshears, V. H. Dale, R. W. Malmsheimer, R. N. Sampson, B. Sohngen, and C. W. Woodall. 2014. “Ch. 7: Forests. Climate Change Impacts in the United States: The Third National Climate Assessment.” U.S. Global Change Research Program. https://doi.org/10.7930/J0Z60KZC.

[18] Keane, Robert E., Paul F. Hessburg, Peter B. Landres, Fred J. Swanson. *The use of historical range and variability (HRV) in landscape management.* Forest Ecology and Management, j.foreco.2009.05.035, May 2009. https://www.fs.usda.gov/research/treesearch/33776

[19] Kimmerer, Robin Wall. 2013. *Braiding Sweetgrass*. First edition. Minneapolis, Minnesota: Milkweed Editions. https://www.goodreads.com/book/show/17465709-braiding-sweetgrass.

[20] Kreutzweiser, David P., Scott S. Capell, and Kevin P. Good. 2005. “Effects of Fine Sediment Inputs from a Logging Road on Stream Insect Communities:A Large-Scale Experimental Approach in a Canadian Headwater Stream.” *Aquatic Ecology* 39 (1): 55–66. https://doi.org/10.1007/s10452-004-5066-y.

[21] Law, Beverly E., Logan T. Berner, Polly C. Buotte, David J. Mildrexler, and William J. Ripple. 2021. “Strategic Forest Reserves Can Protect Biodiversity in the Western United States and Mitigate Climate Change.” *Communications Earth & Environment* 2 (1): 254.

https://doi.org/10.1038/s43247-021-00326-0.

[22] Law, Beverly E., Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, and Mark E. Harmon. 2018. “Land Use Strategies to Mitigate Climate Change in Carbon Dense Temperate Forests.” *Proceedings of the National Academy of Sciences* 115 (14): 3663–68. https://doi.org/10.1073/pnas.1720064115.

[23] Law, Beverly E., William R. Moomaw, Tara W. Hudiburg, William H. Schlesinger, John D. Sterman, and George M. Woodwell. 2022. “Creating Strategic Reserves to Protect Forest Carbon and Reduce Biodiversity Losses in the United States.” *Land* 11 (5): 721. https://doi.org/10.3390/land11050721.

[24] Law, B.E., P.E. Thornton, J. Irvine, P.M. Anthoni, and S. Van Tuyl. 2001. “Carbon Storage and Fluxes in Ponderosa Pine Forests at Different Developmental Stages: CARBON IN PONDEROSA PINE FORESTS.” *Global Change Biology* 7 (7): 755–77. https://doi.org/10.1046/j.1354-1013.2001.00439.x.

[25] Lowe, John E. 1995. “Decision Notice for the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales.” Decision Notice, Regional Forester’s Amendment No. 2. United States Forest Service. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd972828.pdf.

[26] Maloof, Joan, and Andrew Joslin. 2016. *Nature’s Temples: The Complex World of Old-Growth Forests*. Portland, Oregon: Timber Press. https://www.goodreads.com/book/show/28009889-nature-s-temples.

[27] Mathews, Daniel. 2020. *Trees in Trouble: Wildfires, infestations, and climate change*.

[28] McGuigan, Connor. 2022. “5 Ways to Protect Your Home From Wildfires.” May 7, 2022. https://www.sierraclub.org/sierra/5-ways-protect-your-home-wildfires-0.

[29] McHugh, Peter A., W. Carl Saunders, Nicolaas Bouwes, C. Eric Wall, Sara Bangen, Joseph M. Wheaton, Matthew Nahorniak, James R. Ruzycki, Ian A. Tattam, and Chris E. Jordan. 2017. “Linking Models across Scales to Assess the Viability and Restoration Potential of a Threatened Population of Steelhead (Oncorhynchus Mykiss) in the Middle Fork John Day River, Oregon, USA.” *Ecological Modelling* 355 (July): 24–38. https://doi.org/10.1016/j.ecolmodel.2017.03.022.

[30] Mildrexler, David J., Logan T. Berner, Beverly E. Law, Richard A. Birdsey, and William R. Moomaw. 2020. “Large Trees Dominate Carbon Storage in Forests East of the Cascade Crest in the United States Pacific Northwest.” *Frontiers in Forests and Global Change* 3 (November): 594274. https://doi.org/10.3389/ffgc.2020.594274.

[31] ———. 2023. “Protect Large Trees for Climate Mitigation, Biodiversity, and Forest Resilience.” *Conservation Science and Practice*, April, e12944.

https://doi.org/10.1111/csp2.12944.

[32] Millar, Constance I. *Historic Variability: Informing Restoration Strategies, Not Prescribing Targets.* Journal of Sustainable Forestry, 33:S28-S42, 2014. https://srs.fs.usda.gov/pubs/47361

[33] Miserendino, M. Laura, and Carolina I. Masi. 2010. "The Effects of Land Use on Environmental Features and Functional Organization of Macroinvertebrate Communities in Patagonian Low Order Streams." *Ecological Indicators* 10 (2): 311–19. https://doi.org/10.1016/j.ecolind.2009.06.008.

[34] "NFPA - Firewise USA®." n.d. Accessed July 3, 2023. https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA.

[35] Nonaka, E., and T. A. Spies. "HISTORICAL RANGE OF VARIABILITY IN LANDSCAPE STRUCTURE: A SIMULATION STUDY IN OREGON, USA," *Ecological Applications*, vol. 15, no. 5, pp. 1727–1746, Oct. 2005, doi: 10.1890/04-0902.

[36] *Panel on Logging in Streamside Corridors, John Day, Oregon 2017*. 2017. John Day, Oregon: Blue Mountains Biodiversity Project. https://bluemountainsbiodiversityproject.org/panel-on-logging-in-streamside-corridors-john-day-oregon-2017/.

[37] Prichard, Susan J., Ze'ev Gedalof, W. Wyatt Oswald, and David L. Peterson. 2009. "Holocene Fire and Vegetation Dynamics in a Montane Forest, North Cascade Range, Washington, USA." *Quaternary Research DOI: 10.1016/j.Yqres.2009.03.008* 72: 57–67.

[38] Quaempts, Eric J., Krista L. Jones, Scott J. O'Daniel, Timothy J. Beechie, and Geoffrey C. Poole. 2018. "Aligning Environmental Management with Ecosystem Resilience: A First Foods Example from the Confederated Tribes of the Umatilla Indian Reservation, Oregon, USA." *Ecology and Society* 23 (2): art29. https://doi.org/10.5751/ES-10080-230229.

[39] Ratner, Susan, Russell Lande, and Brett B. Roper. 1997. "Population Viability Analysis of Spring Chinook Salmon in the South Umpqua River, Oregon. Analisis de Viabilidad Poblacional Del Salmon Chinook de Primavera En El Rio South Umpqua, Oregon." *Conservation Biology* 11 (4): 879–89. https://doi.org/10.1046/j.1523-1739.1997.95457.x.

[40] Rawlence, Ben. 2022. *The Treeline: The Last Forest and the Future of Life on Earth*. First edition. New York: St. Martin's Press. https://www.goodreads.com/book/show/56268809-the-treeline.

[41] Schowalter, T.D., J.A. Noriega, and T. Tscharntke. 2018. "Insect Effects on Ecosystem Services—Introduction." *Basic and Applied Ecology* 26 (February): 1–7. https://doi.org/10.1016/j.baae.2017.09.011.

[42] *Science News*. 2006. "Global Warming May Warrant New Approaches To Ecosystem Restoration," June 15, 2006.

https://www.sciencedaily.com/releases/2006/06/060615082745.htm.

[43] Simard, S. 2021. *Finding the Mother Tree: Discovering the Wisdom of the Forest*. First edition. New York: Alfred A. Knopf. https://www.goodreads.com/book/show/54976983-finding-the-mother-tree.

[44] Simpson, M., D. Zalunardo, A. Eglitis, D.C. Wood, D.R. Roy, and S.J. Johnson. 1994. “Viable Ecosystem Management Guide (Draft).” Ochoco National Forest. USDA Forest Service.

[45] Stephenson, N. L., A. J. Das, R. Condit, S. E. Russo, P. J. Baker, N. G. Beckman, D. A. Coomes, et al. 2014. “Rate of Tree Carbon Accumulation Increases Continuously with Tree Size.” *Nature* 507 (7490): 90–93. https://doi.org/10.1038/nature12914.