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28 November 2023

To:
Jennifer Abernathy, NEPA Planner
Ochoco National Forest
3160 NE 3rd Street
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Regarding: North Fork Crooked River Forest Resilience Project, Draft Environmental Assessment, https://www.fs.usda.gov/project/?project=61651

Jennifer Abernathy and Ochoco National Forest:

The Juniper Group Sierra Club, representing over 2000 members in Eastern Oregon counties, is responding to the Forest Service (FS), Ochoco National Forest (ONF) request for comments on North Fork Crooked River (NFCR) Forest Resilience Project, Draft Environmental Assessment (DEA), project 61651 (or simply 61651).

The mission of the Sierra Club[1] is:

- To explore, enjoy, and protect the wild places of the earth;
- To practice and promote the responsible use of the earth's ecosystems and resources;
- To educate and enlist humanity to protect and restore the quality of the natural and human environment; and to use all lawful means to carry out these objectives.

We are filing comments for 61651 in part to protect wild places, to educate, and to restore the quality of the natural and human environment.

We appreciate the amount of work that the ONF staff has done to prepare 61651. This Project proposes actions intended to meet a wide variety of purposes including reducing wildfire risk, increasing forest health and vigor for timber and non-timber values, and improving fish and wildlife habitat. The project encompasses 37,577 acres in the Paulina Ranger District of which approximately 11,000 acres are proposed for “treatments”, including commercial harvest, thinning, prescribed burning, road reconstruction, temporary roads, some road closures and decommissioning.

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 61651 and ONF reasoning and end with some specific recommendations for an improved project alternative.

1 https://www.sierraclub.org/about-sierra-club

Topics

Overall Impressions

The ONF is using paradigms that are biased toward one aspect of its mission, productivity.[2] In this section we discuss issues of forest management on our public forest lands and we use the best available, peer-reviewed scientific reports which emphasize the need for total ecosystem health and biodiversity, for both short and long-term forest and community benefits.

HRV Goal Improper

The continued use of Historic Range of Variability (HRV) as a management goal for forested vegetation structural stages by ONF is a frustration to 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* [62] derived from weak data,[3] but more

2 "The mission of the Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations." https://www.fs.usda.gov/about-agency/meet-forest-service

3 The discussion on HRV in this comment is somewhat truncated, as it has been presented before to ONF 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

importantly, this historic data does not fit with how climate is driving changes to forest vegetation and how to best manage for future conditions.

While 61651 aims to restore forest structure 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 by Millar: https://srs.fs.usda.gov/pubs/47361 ([48]). The ONF must, instead of looking back, look forward to protect large and old trees, and allow ecosystems to unfold that will dominate the conditions we will see in the next 100 years. Using passive management and letting natural processes adapt the biota to the changing conditions is the most appropriate approach to achieve this.

The use of HRV for management decisions was first promoted in the 1990's, about the same time ONF draft report currently used [62] was written. In 2009, Keane *et al.* [30] pointed out weaknesses and pitfalls in using HRV while still holding it as a possible aid, with limitations. The authors 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 how to use HRV in forest management. For example, see: *Trees in Trouble*, by Daniel Mathews [43]; *The Treeline*, by Ben Rawlence [57]; and Nonaka, *et al.* [51]. What 61651 does instead is try to achieve HRV directly in alternatives it proposes.

HRV as a management goal also fails to 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. Other natural processes to consider are natural plant succession and the interactions of flora and fauna, as influences by the geologic conditions of each site and microsite. Accurate management and control of nature is unlikely. 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 today. We suggest that the agency needs to tolerate more dense stands, as occurs in natural plant succession, while allowing for enough variability so that disturbances are limited by discontinuities on the landscape. The post-disturbance landscapes must be allowed to recover their complexity.

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references to more peer-reviewed papers.

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 published papers and analyses have concluded that global warming warrants new approaches to ecosystem restoration. (For example, [60].) Even a researcher frequently used and supported by the Forest Service has made the use of HRV a conditional, limited tool ([27], pp. 9-10):

> "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."

The reference in 61651 to the use of HRV by the Eastside Screens (61651, p. 6) is presented as if the Screens supports such use. 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 [40]:

> "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 [62] by ONF for deciding to use those assumed conditions to direct treatments for management objectives. It is also true that forests have changed given ongoing management practices of large diameter timber (high grading) harvest, extensive roading, and intense livestock grazing. Species composition in the ecosystem have also changed with, for example, the extirpation of large predators and new invasive plant species. The ONF should drop arguments that a restoration of tree species to HRV composition also restores a resilient forest. If HRV is to be used to return forests to their historic levels of tree composition, levels of human intrusion must also be restored, including reducing road density and other disturbances and modifications (grazing, harvesting), if this is to be an honest goal for management.

Wildfire Is 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 [44] and as promoted by the NFPA Firewise program [50]. 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."([25], 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 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. ([14], [54])

Project 61651 includes goals for reducing wildfire fuels and other wildfire management practices. 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 (dead wood becomes soil becomes new 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 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 [42]. 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. This project must account for how it disrupts ecological systems, wildlife habitat, and biodiversity in ways that natural disturbances do not. As noted by Johnson, *et al.* [26], page 350:

> "Viewing forests as ecosystems rather than simply as collections of trees lay at the heart of the shift from tree farms to natural forests as models for management..."

For example, a study by Bradley, *et al.*, [9] found that less management resulted in lower severity fires. As stated by Maloof [42]:

> "[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 overall which is reflected by the ONF on this DEA. For example, one study ([3]) questions the FS analysis of fire history[4]; another points to the effect of climate on fire behavior ([54]). Even 61651 notes that vegetation departure is due, at least in part, to "fire suppression policies" (p. 36). Given the past 100 years of mis-management of forests that has resulted in the current condition, and the ongoing debate about appropriate forest and fire management, we believe less management is the appropriate course of action.

Like previous projects such as Wolf, Black Mountain, Mill Creek and now the NFCR project, the ONF uses the threat of wildfire to promote the FS paradigm on why "restoration" and "management" are needed to bring resilience to our public lands. However, new science is showing the importance of a variety of wildfires from low severity at frequent intervals to mid severity and occasional high severity fires. The FS has failed to incorporate new peer-reviewed science that promotes not just low severity but occasionally moderate and high severity wildfires as part of the landscape. It's time for the ONF to quit ignoring and even disparaging the best science that recognizes that a variety of fire severity are part of the ecosystem mix. Though modern fire suppression efforts may have reduced the spread of

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

some wildfires, it has not reduced the occurrence of the 1% of large and extreme wildfires that are responsible for 90% of the total damage caused by wildfires.

Not all wildfires are bad and in fact many serve important ecosystem functions for restoration and wildlife habitats ([24], [13], [21]). For example, Hutto *et al.* [24] reported that:

> "First, many plant and animal species use, and have sometimes evolved to depend on, severely burned forest conditions for their persistence. Second, evidence from fire history studies also suggests that a complex mosaic of severely burned conifer patches was common historically in the West. Third, to maintain ecological integrity in forests born of mixed-severity fire, land managers will have to accept some severe fire and maintain the integrity of its aftermath. Lastly, public education messages surrounding fire could be modified so that people better understand, and support management designed to maintain ecologically appropriate sizes and distributions of severe fire and the complex early seral forest conditions it creates."

DellaSala [13] reports that:

> "In our region, and much of the West, wildfires burn in a mixed pattern of severity effects on plant communities. The largest wildfires are not uniform conflagrations – rather they burn in a mosaic pattern of mixed severity effects (unburned, low, moderate, high severity burn patches). At the landscape scale, this pattern has been referred to as 'pyrodiversity' and it is responsible for Oregon's extraordinary levels of biodiversity present in wildfire burn mosaics. Most notably, the high severity burn patches where most trees are killed (known as 'complex early seral forests,' snag forests, or charcoal forests are as bio-diverse as patches of old-growth forests."

DellaSala [13] also states that:

> "Active management is often proclaimed as a panacea for reducing wildfire-human conflicts, yet it is seldom even defined. Active management can mean just about anything – clearcut logging, salvage logging, high-grade logging, fuels reduction, prescribed fire, thinning, road building, etc. And while degraded forests like plantations can benefit from ecologically appropriate thinning and other restorative actions (snag creation, down logs, road obliteration, weed removals), in most cases thinning – even if done properly – will not encounter a fire during the short period (10-15 years) of when fuels are lowest.
>
> The Oregon landscape is so vast and efforts to spend billions of dollars on thinning are not likely to be effective nor will they make us safer. This is because we do not know exactly where wildfires will occur, and thinned forests will just grow back quickly in many cases. In fact, the largest empirical dataset ever assembled by researchers recently documented the low co-occurrence of wildfires and thinned sites. Some 99% of thousands of acres of fuels treatments on federal lands did not encounter a wildfire when fuels were lowest. Further, these same researchers found that despite the emphasis on the so-called WUI, codified in the Healthy Forest Restoration Act of 2003, most fuel treatments were being conducted outside this zone and in the backcountry where they will do nothing to protect homes."

Wildfires produce far less carbon emissions than timber industrial forests (Figure 1). The more managed lands have a generally greater risk of fire severity ([9], [35], [42]).

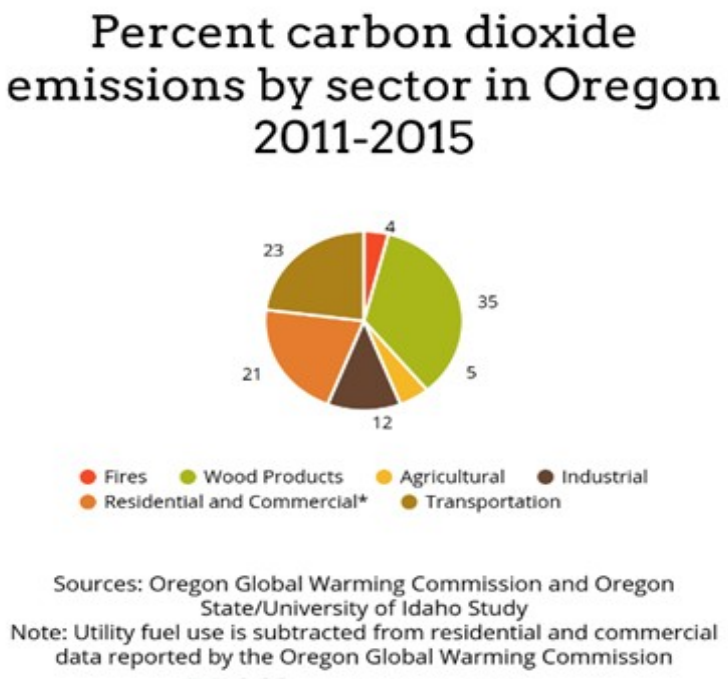

Figure 1: Annual Oregon carbon emissions, 2011-2015 (Data from [35])

Bradley *et al.* [9] documented that climate change and extreme weather events combine with more heavily managed industrial forests to produce more mega wildfire events (Figure 2). Data over a three-decade period, from 1984-2016, showed that 1,500 wildfires greater than 1,000 acres that covered over 23 million acres in western and great plains states had a much higher burn severity in managed versus unmanaged forests. The authors, after averaging out effects of elevation and climate, show that “forests with higher levels of protection had lower severity values even though they are generally identified as having the highest overall levels of biomass and fuel loading”. They also state “a need for managers and policymakers to rethink current forest and fire management direction, particularly proposals that seek to weaken forest protections or suspend environmental laws ostensibly to facilitate a more extensive and industrial forest–fire management regime.”

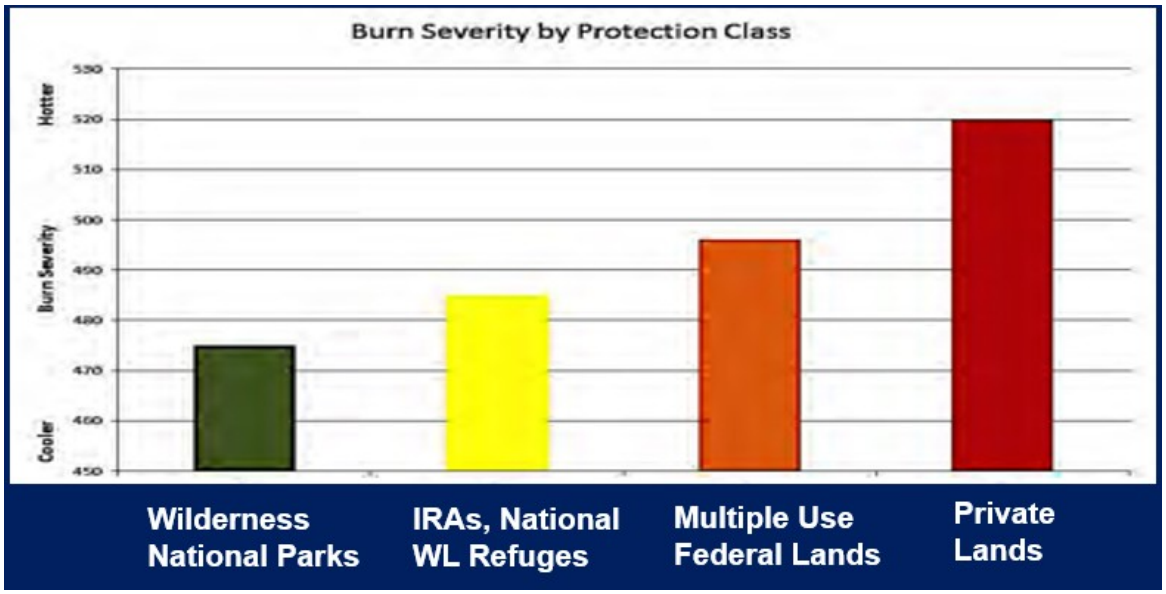

Figure 2: A comparison of burn severity across land protection class. The higher the level of protection from management, the less the burn severity (Data from [9])

Bradley *et al.* [9] recommend that:

> "allowing wildfires to burn under safe conditions is an effective restoration tool for achieving landscape heterogeneity and biodiversity conservation objectives in regions where high levels of biodiversity are associated with mixed-intensity fires. Managers concerned about fires can close and decommission roads that contribute to human-caused fire ignitions and treat fire-prone tree plantations where fires have been shown to burn uncharacteristically severe (Odion et al. 2004). Prioritizing fuel treatments to flammable vegetation adjacent to homes along with specific measures that reduce fire risks to home structures are precautionary steps for allowing more fires to proceed safely in the backcountry (Moritz 2014, DellaSala et al. 2015, Moritz and Knowles 2016)."

Berner *et al.* [5] (Figure 3) reports that the tree mortality is highest in Oregon among the 11 western states with timber harvest causing 83% of tree mortality, with bark beetles and wildfire causing substantially less mortality at 9% and 8%, respectively.

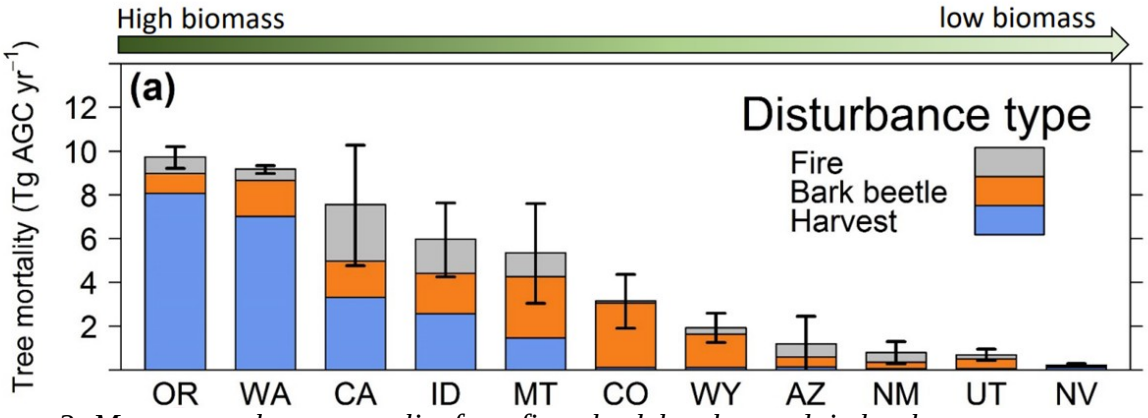

Figure 3: Mean annual tree mortality from fires, bark beetles, and timber harvest on forestland from 2003–2012 for each state in the western US. Tree mortality was quantified as the amount of aboveground carbon (AGC) stored in tree biomass killed by disturbance ([5])

Large, high severity fires have been part of history during previous warm and dry weather cycles. Keeley and Syphard [31] studied large fires in a historical context by examining records of large fire events in California back to as early as 1860. They note that drought is commonly associated with large fire events. Despite the large fires in recent years, they found that:

> "there have been other periods with even greater numbers of large fires, e.g., 1929 had the second greatest number of large fires. In fact, the 1920's decade stands out as one with many large fires" …" Earlier records show fires of similar size in the nineteenth and early twentieth century. Lengthy droughts, as measured by the Palmer Drought Severity Index (PDSI), were associated with the peaks in large fires in both the 1920s and the early twenty first century"

Another example is from 1910, Ed Pulaski became a hero when he saved numerous miners from the "Big Burn" [16], a fire that consumed over three million acres in three different states in 36 hours. In other words, long before the FS declared that overstocked forest stands must be reduced, during hot, dry, windy conditions, large areas of forests already burned with high severity, particularly during drought cycles.

In 1929, at the beginning of the Dust Bowl era, an astounding 50 million acres burned across the West. Today, officials declare that a season total of 10 million acres is a "record year". Figure 4 shows that large fires burned much greater land area in the 1920s during the Dust Bowl days than in the recent decade.

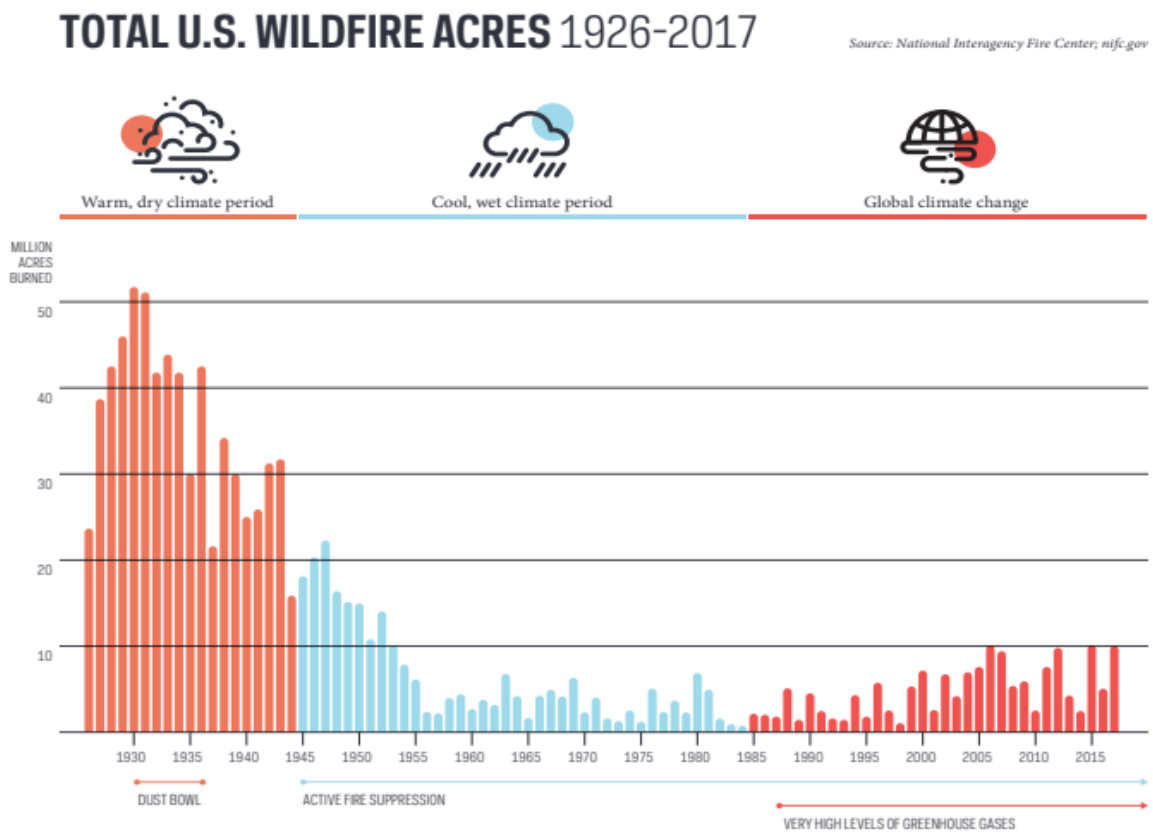

Figure 4: The West experienced drought from the 1900s to the 1930s, which led to wildfires burning tens of millions of acres. A cool, wet period from the 1940s to 1980s led to far less wildfires in the landscape. Since the late 1980s, climate change has caused hotter, drier conditions, causing an increase in wildfires. Source National Interagency Fire Center.

The wildfire statistics show that there were fewer large blazes between the 1940s and 1980s. This was one of the wettest periods in centuries. It was so snowy and cold that glaciers in the Pacific Northwest grew more than ever since the Little Ice Age. Beginning in the late 1980s, with increased carbon emissions, the climate became hotter and drier with more drought conditions. With increased hotter, drier conditions, large wildfires have occurred more frequently across the west.

Furthermore, thinning forests as “treatments” for forest resiliency and limiting wildfires are a shot in the dark. It’s impossible to predict where wildfires will burn in the vast landscape of western forests. Schoennagel *et al.* ([58]) and Barnett *et al.* ([4]) show that less than 1% of thinned areas actually encounter wildfire each year, which means that the vast majority of thinning treatments are ineffective at influencing wildfires.

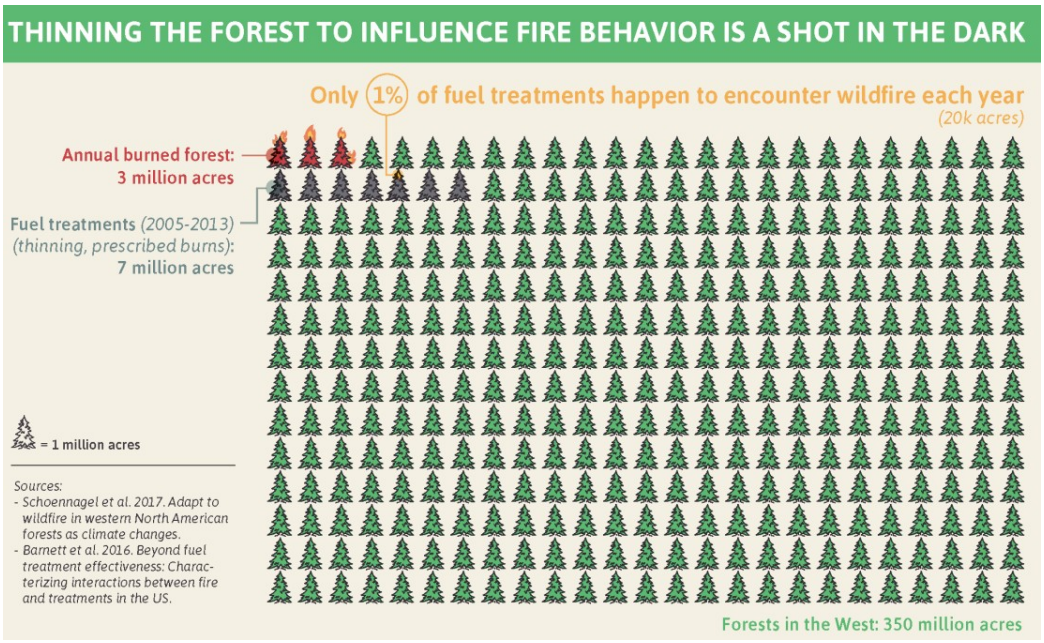

Figure 5: There is only a 1% chance of a wildfire likely to occur in an area treated by thinning under the guise of reducing stand density and wildfire risk.

From these analyses, we conclude that the FS is using the threat of wildfire to conduct more and larger areas of timber harvest under the guise of "resiliency" and "restoration". While in some dry site ponderosa pine forests, proximate to communities and structures, thinning and harvest is warranted, the proposed thinning and harvest of large project areas away from towns is unwarranted and will likely have severe impacts on cool, moist forested areas, old growth and large multilayered stands that provide essential services for carbon storage, biodiversity, soil and nutrient cycling and water quality. These harvest strategies add to our climate change woes by adding substantially more carbon emissions.

The FS also uses the paradigm of harvesting low elevation ponderosa pine to achieve "park-like stands" and "increase wildfire resilience". It is scientifically wrong to apply the same strategy to other tree species in the forest, including larch, lodgepole pine, subalpine fir, Douglas fir, and others, which have longer fire-free intervals and were seldom open and park-like. Some species like lodgepole pine have a shorter life span and rely on wildfire to replace stands and their serotinous cones rely on wildfire to open the cones and reproduce new trees such as the Hash Rock Fire in 2000 on the project area.

Resource Extraction or Long-Term Health

The ONF is a multi-use forest, but has put a priority on resource extraction, mostly in the production of timber and grazing forage (61651, p. 5). On page 10 we see that Alternative 2 will produce 24.5 mmbf and Alternative 3 18.1 mmbf. In Table 5, page 17, we see that 100% of the project area is under grazing allotments. Page 177 states, "This area has been managed primarily for the land's natural resources for timber and grazing."

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 [6], 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.

The creation of long-term economic benefits for both the local and broader community requires actions that benefit the long-term health of the forest ecosystem. This includes expanding old-growth and LOS areas for the benefits provided by such ecosystems: refugia, ecosystem services, and carbon sequestration to name a few. While 61651 discounts the effects of anthropogenic climate change (p. 193), the report used to support its diminution analysis ([19]) states (p. v), "The effects of climate change on hydrology will be highly significant" and "Projected changes in climate and hydrology will have far-reaching effects on aquatic and terrestrial ecosystems" and "is expected to cause gradual changes in the abundance and distribution of tree and shrub species".

With the large portion of the 61651 project area classed as non-forested[5], we also note that the FS report by Halofsky, *et al.* [19] states (p. viii) "Land use conversion, grazing, and nonnative species will compound the effects of climate change on shrubland and grassland." This is hard to reconcile with the statement in 61651 (p, 2), "Reducing tree density along the scabland stringers will help to open the existing scablands and will help reinvigorate grasses, forbs and sagebrush." This seems to reflect short-term economic thinking rather than multi-generational planning for sustainability and forest health.

Cumulative Effects Analysis Incomplete

The cumulative effects analysis of 61651 is limited to the project area. As stated on page 18, "The geographic scope for direct, indirect and cumulative effects is the project area." This 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 areas with projects that also affect migration routes, riparian disturbances, wildlife disturbance, and human activities. This broad landscape continuity and cross-boundary effects are clearly implied as stated on page 3:

> "This project borders vegetation management projects that we either implemented recently or are presently implementing: Black Mountain (signed 2019), Gap (2016), Wolf Creek (2014), and Jackson (2012). This project would create landscape scale continuity of more resilient forests in this part of the Ochoco National Forest."

This DEA differs from others created by ONF in not creating a single section to deal with cumulative effects, but fragments this analysis into each individual resource analysis. (As described on p. 17.) This ignores how interrelated resources are and how actions to adjust one resource affect others. As noted in the previous section, 61651 on page 2 states that opening forests (harvesting to reducing tree density) will expand grasslands. Yet the argument presented in 61651 for almost every resource is "Because there are no other proposed actions in the project area that could have an effect on [this resource], there would be no cumulative effect from this alternative." Yet ONF active management is designed to affect the ecosystem as a whole and across project boundaries for resource extraction or recreational activities.

5 61651 p. 2, "46% (17,540 acres) is non-forested (scabland or juniper woodland)".

The ONF is under pressure to meet a quota for timber harvesting (see Mill Creek DEA, FS project 58081, p. 238). 61651 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.

The ONF does not exist by itself in the Blue Mountain Ecoregion[6]. Other forests in this region are also seeing increased human use and human disturbance, as well as pressure to increase logging and maintain grazing. The Blue Mountains also 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 61651 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 the image in Figure 6, scraped from The Nature Conservancy website about animal migration routes [22]:

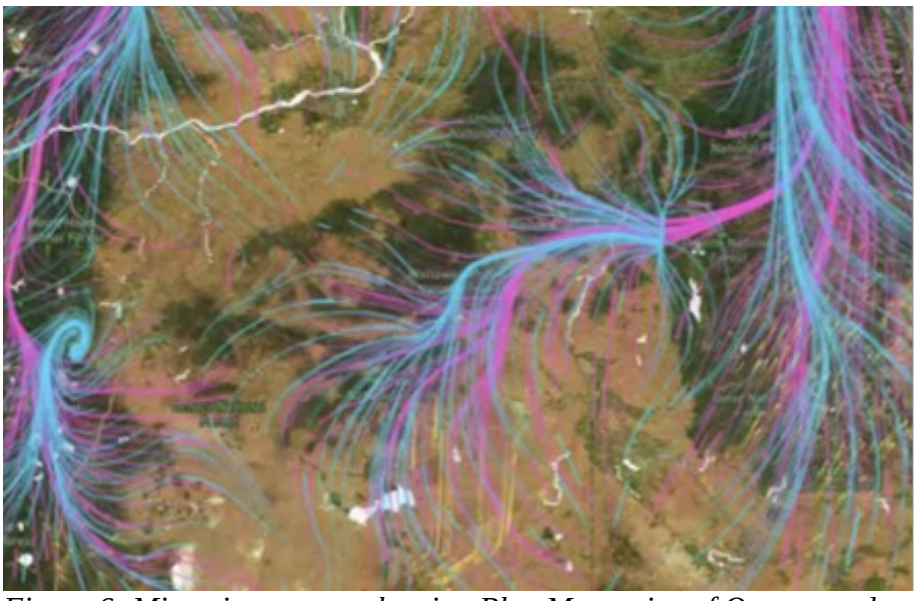

Figure 6: Migration routes, showing Blue Mountains of Oregon and into Idaho

Even though the ONF lacks a modern, updated forest plan, and other efforts have begun to update the Blue Mountain forest plans overall[7], this does not exempt projects like 61651 from looking at the big picture. Cumulative effects extend well beyond the boundary of this project.

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

6 US EPA Ecoregions: https://en.wikipedia.org/wiki/List_of_ecoregions_in_the_United_States_(EPA)
7 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.[8]

Ecosystem services is minimally addressed in 61651 on page 122 as an objective to "provide for ecosystem services (e.g., nutrient cycling or water storage)" and as part of a watershed discussion on page 133 where it includes services that provide high-quality water and moderation of climate variability and change. This ignores the FS Climate Adaptation Plan [11], Adaptation Action 4 on page 6, "Support the delivery of ecosystem products and services in a changing climate." The FS report (frequently referenced in 61651), Climate Change Vulnerability [19], highlights carbon sequestration as an ecosystem service starting on page 412 and in several other places. Why is this discussion missing from 61651?

Leaving out the discussion of ecosystem services 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 our local community 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 ([29], [55]). 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: [32], [59], [61])

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 noted on page 5 of 61651. 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, 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[9].

Timber and forage production 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 (forage) production.

Need to Conduct an Environmental Impact Statement

The NFCR project is essentially a very similar project to the Black Mountain project, which was conducted with an Environmental Impact Statement (EIS). An EIS is conducted when a project is expected to have significant environmental impacts and generally has more analyses than an EA. The Black Mountain Project authorized management activities on 15,810 acres of national forestland, including logging, roadwork, prescribed burning, and restoration. The Black Mountain DEIS and FEIS

8 For more on ecosystem services, see: https://en.wikipedia.org/wiki/Ecosystem_service
9 Lemon Gulch is more of an experience, or recreational area, than a recreational trail.

described that “The Ochoco National Forest has prepared this Draft/Final Environmental Impact Statement (DEIS/FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This DEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.”

The Black Mountain project has a smaller project area than the NFCR project area (15,801 acres vs 37,577 acres) and less timber volume harvested (17.8 mmbf vs Alt 2, 24.5 mmbf, Alt 3, 18.1 mmbf). The projects proposed are strikingly similar in purpose and need, alternatives, and proposed management strategies. We question why the ONF has decided to issue an EA which generally has less analyses and by virtue of an EA concludes ahead of the process that there are no significant impacts. We assert that these similar projects with similar impacts indicates that an EIS is required for this NFCR project.

Furthermore, the EA process normally is used to determine the significance of the environmental effects and evaluate alternatives to achieve the agency’s objectives, a shorter and faster process than an EIS, and is used when there are minimal environmental impacts. An EIS is used when a project will have significant environmental effects. This DEA shows that there will be numerous and significant environmental impacts including extensive treatments and new roads over 11,000+ acres, impacts to RHCAs, LOS, connectivity wildlife corridors, and a wide variety of native fish and wildlife species including redband trout, mule deer, elk, goshawks, pileated woodpeckers, and scarce pollinators such as bumble bees, which indicates that the project requires an EIS.

Harvesting Large Trees

Removing large trees, that is, trees great than 21-inch DBH, runs counter to the environmental 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 to the local timber industry, 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 where the Mill Creek DEA has an objective to “maintain natural-appearing forest stands” (FS project 58081, DEA p. 21) and 61651 section Visual Management Corridor starting on page 183.

Large trees are especially significant for carbon storage and biodiversity. (See [34], [46], [47]) 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 [34] a framework and maps that are ready for the FS to apply on western national forests. This message was repeated in the 2022 paper [36], 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.[10] 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 (FS) 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* [43] 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.

10 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

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

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.

The elk numbers in the Project area are below Oregon Department of Fish and Wildlife's (ODFW) set management levels (noted on 61651 p. 69), 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." (p. 69)

Further, the DEA inadequately analyzes how current cattle allotments impact elk habitats. With 100% or the project area under grazing allotments, it is obvious that grazing degrades the elk habitat through competition for forage and presence on the landscape. There should be a specific analysis by project alternatives 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. As 61651 states (page 74), "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".

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 ([56], [45]). 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 of streams and riparian areas ([7]). 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]).

We note the honesty of 61651 in reporting the failure of ONF to meet INFISH goals (p. 129):

> "Observations from data collected from the early 1990s through present indicate that most of the streams within the project area are not meeting management objectives of 80% shaded surface or greater (Table 82, Appendix E).
>
> Temperature data was summarized from the only long-term deployed data logger in the project area located in the lower North Fork Crooked River, downstream of the confluence with Deep Creek (the main cold-water input tributary). It is deployed high up in the project area. Due to a lack of data from other reaches and streams within the project area, these data were extrapolated to represent the whole project area. Figure 16 summarizes available data from 2005 to present. Water temperature has not met INFISH standards in any of the years of available data."

Even this paucity of data indicates the critical condition of the waters in the project area. Proposed action alternatives will only make it worse. Note Figure 16 from 61651 page 130:

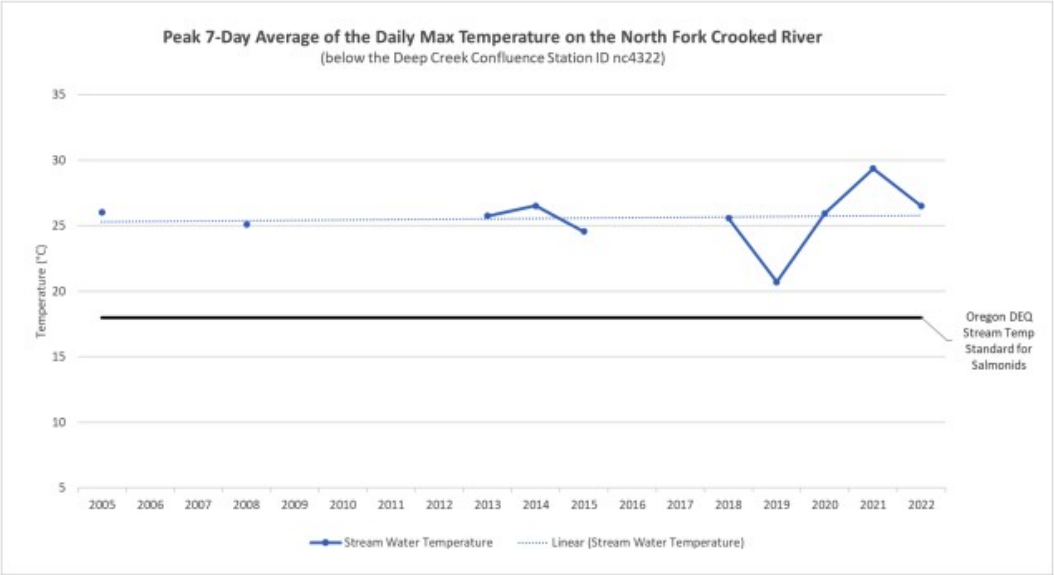

Figure 16. Available stream temperature data from the only long-term deployed data logger in the project area located in the lower North Fork Crooked River, just downstream of the confluence with Deep Creek.

61651 erroneously states (p. 135) that "Conifers reduce water availability for deep-rooted riparian vegetation (willows, sedges, rushes) that are important to stabilize streambanks, trap sediment, and provide shade for cooler stream temperatures.)." In fact, several authors have reported the importance of conifers in riparian communities because they provide the structural complexity that supports higher species diversity and richness, important microclimates, and provide LWD for riparian areas and streams that deciduous shrubs cannot (Kauffman 1988[11], [41], [53]). Furthermore, the assumption that logging conifers will restore hardwoods across the project area RHCAs is faulty. Conifers are

11 Kauffman, J. B. 1988. The status of riparian habitats in Pacific Northwest forests. Pages 45-55 in K. J. Raedeke, ed. Streamside management: riparian wildlife and forestry interactions. College of Forest Resources, Contribution No. 59, University of Washington, Seattle.

frequently found in a floodplain that has been disconnected from the incised stream channel and is caused by past and present land management practices of grazing, roads, and timber harvest. This flawed assumption, that conifers cause stream degradation, which we found in multiple places in 61651, and invalidates the environmental impact analysis.

The 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 ([8]).

Studies have shown that logging, even selective logging, has increased instream fine sediments ([33], [49]) and increased instream water temperatures ([18]) 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 ([52]).

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 ([52]) via the release of nutrients and increases in sediment and stream temperatures.

The Standard and Guideline for the Wild and Scenic North Fork Crooked River states that “No scheduled timber harvest, in foreground views from the river, shall be allowed. Timber harvest as necessary to maintain or enhance scenic, recreational, or water quality objectives may be permitted” (USDI and USDA, 1993[12]).

We also note that according to 61651 Appendix E, Stream Survey Data, out of 48 stream reaches that have been surveyed at least once since 1991, only 4 have been surveyed in the last 5 years. Of these, most of the Riparian Management Objectives were found to be failing. Again we see ONF is failing both at monitoring and at achieving management objectives.

In addition to the general lack of historical and current data, and trends, we could not find in the DEA or Wildlife Report any maps, descriptions, locations, or detailed analysis of the RHCAs and Class I-IV streams and how the proposed treatments will move streams toward attainment of the RMOs in each of the 4 classes of RHCAs. The public cannot fully review and assess the ONF’s proposed management

12 USDI and USDA. 1993. North Fork Crooked River Management Plan. 130 pp.

activities and impacts to RHCAs, steams and aquatic species without full disclosure of important project information that should be available in the DEA and specialist reports.

Roads and Travel Management

We support the Purpose and Need to achieve a “Minimum Road System” (p. 4) for the reasons that roads have of negative impacts on habitat security for big game and increase habitat fragmentation. (Or, “decrease habitat connectivity”, 61651 p. 4.) We also note some of many other reasons for minimizing the road system:

- wildlife disturbance of all species, not just big game
- increased water runoff
- increases sediment delivered to streams
- partial barriers to distribution of native plants and smaller animals
- invasive species corridors
- disturbance of non-motorized recreationalists
- illegal driving of closed roads and off-road driving
- increased intrusions by motors for recreation, firewood cutting, and more
- reduces financial expenditures for construction, maintenance, monitoring

We note that 61651 Table 29 (p. 71) reports that the Forest Plan sets an open road density of 3 mi/mi^2, and all alternatives are below this. That is good, and we support dropping it even more.

It is common across the ONF for closed roads to be driven. This is also noted in 61651 in various places. We encourage better physical closing practices as well as enforcement, although that is difficult.

We also wish to point out that Administrative Maintenance Level 2 roads, “administrative use only road (e.g., gated road)”, are also driven legally at levels not reported or monitored, by ONF personnel, grazing allotment holders, adjacent landowners, timber purchasers and contractors, and others. Illegal use is also commonplace. This usage causes wildlife disturbance and ongoing erosion of the landscape, and must be considered in the overall analysis, including in road density reporting. In effect, ML 2A roads are open roads.

Table C-3 (pp. 257ff) indicates that some roads at level “1-Basic Custodial Care (Closed)” will be changed to “2A-Admin High Clearance Vehicles” (definitions 61651 p. 166); that is, closed roads will be opened, albeit not to the public. This does not appear in Table 4, Proposed Road Changes, on page 16, but we do see it on page 170 in Table 66, Road maintenance level changes. (Table 66 also mis-directs readers to Appendix A for the complete list of road segments, it should be Appendix C. This confusing scattering of information about roads throughout 61651 may not be intentional, but it does not help the public!)

As we dig into 61651 for road information, we see Table 29 on page 71 reports an open road density of 1.1 mi/mi^2 for the action alternatives, a decrease from 3 mi/mi^2 for the no action alternative. The ONF frequently fails to meet its road density standards and in some places in the forest has road densities as high as 12 mi/mi^2, despite Forest Plan standards. The forest uses “motor vehicle use maps” (MVUM) to designate open roads but fails to physically block closed roads. Hence, they are driven, causing long term and sometimes irreparable harm to water quantity and quality, and fish and wildlife habitats.

In independent surveys by the Oregon Department of Fish and Wildlife (ODFW) and the Great Old Broads for Wilderness, Central Oregon Bitterbrush Broads and Bros chapter (COBB) and conservation partners, all areas surveyed had many closed and some decommissioned and temporary roads driven by users. In the Black Mountain Project areas, over 2/3 of the “closed roads” surveyed were regularly driven by the public, and up to ½ of the “decommissioned roads” were driven as well. Of the 115 roads we surveyed in the Black Mountain project area, adjacent to 61651, the survey documented that 63% of the ML-1 closed roads (45 of 71 ML-1 roads surveyed), 33% of the decommissioned roads (13 of 39), and 5 user-created roads in the Project area that had unauthorized vehicular use. The user-created roads that were observed were part of a much larger network of roads and trails receiving unauthorized use.

ODFW reported similar results of surveys conducted in the proposed 301,000+ acre project area for the Summit Off Highway Vehicle project. They found that 60% of the “closed” roads were regularly driven.

COBB partnered with several other conservation groups and conducted closed road surveys in 2021 in the Mill Creek project area. Despite denser forest and steeper topography than the Black Mountain project area, we found a substantial amount of closed roads that were driven by the public and numerous user-created roads. In the Mill Creek project area, of the 110 closed roads surveyed, 31 (28%) were closed, 66 (60%) were open and illegally driven, and 13 (12%) were not surveyed. COBB also found numerous decommissioned roads and user created roads that were driven but did not enumerate those.

We are concerned about statements like “Because…roads are not receiving regular maintenance, soil and water conditions have degraded around the current transportation system.” (p. 167) Closing roads to reduce the drain on “limited road maintenance funds” (p. 167) is helpful, and benefits the environment as well. We do note that closed road surfaces, even if not illegally driven, will continue to be evident on the landscape and affect water runoff and vegetation for many decades.

Treatment Disturbance

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, and trees no longer have mutual support during times of rain and snowmelt which weaken root holding. Windthrow is the result.

Wind also increases drying of the soil. Further soil drying is increased by the removal of downed debris which cuts the wind, shades the soil, and holds moisture, both in solid form and as it decays to soil organic matter [42]. Soil compaction from harvesting machines and activities also reduce the ability of soil to hold moisture or to transfer it to the water table, more moisture runs off.

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

Spread of Invasive and Noxious Weeds

One of the greatest threats to public lands and native fish and wildlife species and their habitats is the spread of exotic and noxious weeds. Invasive and noxious weeds often colonize disturbed sites where native vegetation has been disturbed, reduced, or removed. Executive Order 13112[13] directs federal agencies to reduce the spread of invasive plants, which is one of the four major threats to ecosystem health.

61651 (p.109) reports that "There are approximately 2,152 gross acres of documented weed infestations in the project area (Table 45). These infestations primarily infest the roadsides and scablands in the project area. Riparian plant communities in the project area have been infested by primarily houndstongue with several other invasive species. Treatment and control options for species in riparian areas are limited due to the difficulty of terrain and access, proximity to water, and the large extent of infestations".

All action alternatives in the project area, including timber harvest, thinning, prescribed burning, road reconstruction, temporary roads, livestock grazing, and other activities, have a high potential for introducing and spreading exotic weeds, including species that are already present, or bringing in new weed species. This can occur on upland sites and meadow, riparian, and wetland sites. While 61651 proposes some resource protection measures, all action alternatives in the project have a high risk of introducing and/or spreading exotic and invasive species to important habitats in violation of the Executive Order above.

61651 (p. 111) reports that "There would be no activities and, therefore, no direct or indirect effects that would change the existing condition. Non-native invasive species would continue to persist at their current rates and could increase through natural means of spread (animals, wind, water) or by humans (vehicles, OHVs, road maintenance)…. Because the no action alternative does not propose entry into recently disturbed areas and no additional ground disturbance related to this project, the risk of introduction, spread, establishment, and persistence for invasive species in the project area would be the lowest of all alternatives." The introduction and spread of nonnative noxious weeds increases substantially in both action alternatives, due to the proposed treatment of most forested acres and some non-forested areas which require bringing in equipment and disturbances to vegetation and soils.

Undeveloped Land

The ONF identified seven undeveloped areas in the NFCR project area (p. 196):

> "the identification of 7 polygons ranging in size from 1,187 acres to 4,436 acres that meets the criteria for undeveloped lands in the NFCR project area (Figure 26). These polygons primarily fall in the scab areas of the scab-stringer landscape."

Alternatives 2 and 3 include proposed activities in the undeveloped polygons, with each alternative proposing treatments over 1,600 acres including commercial harvest, thinning, prescribed burning, and temporary roads. The undeveloped lands should receive no harvest treatment, development, or roads. Such treatments will destroy the character of the undeveloped lands and the undeveloped lands must be left alone and administratively added as Inventoried Roadless Area (IRA).

13 Clinton, W. 1999. Executive Order 13112, February 3, 1999. Agencies to reduce the spread of invasive plants. https://www.invasivespeciesinfo.gov/executive-order-13112

Undeveloped lands are critically important for providing natural habitats, biodiversity, moderating climate impacts, restoring aquifers, and ecosystem services. Undeveloped lands and IRAs comprise a very low percentage of FS lands. Law *et al.* [34] reports that these areas have "crucial biodiversity and carbon benefits", "currently provide clean drinking water for millions of people, support salmon populations and wildlife, and reduce isolation between protected areas". They also recommend that undeveloped lands provide the "potential to meet preservation targets by protecting uninventoried roadless areas (e.g., ~2 Mha in Oregon), many of which are candidates for protection and contiguous with IRAs or existing protected areas". In this case, the undeveloped areas proximity provides great potential multiplier benefits by its proximity to the NFCR Wilderness Study Area.

Loucks *et al.* [39] also reported that over three quarters of the IRAs "have the potential to conserve threatened, endangered, or imperiled species. IRAs would increase the conservation reserve network containing these species by 156%". The authors conclude that IRAs belonging to the FS are one of the most important biotic areas in the nation, and that their status as roadless areas could have lasting and far-reaching effects for biodiversity conservation. Any roadless and untreated area left on the ONF should and must be left intact.

DellaSala *et al.* [15] also reported how critically important roadless are for "affordable drinking water for municipal and rural communities; water for agricultural and industrial uses; flood control; instream aquatic recreation; aquifer recharge; flood protection; reliable water supply; diverse and productive fisheries; healthy aquatic ecosystems; resident and migratory waterfowl habitat; recovery of endangered species; and, increasingly, the vitality and sustainability of local economies" and that these "benefits accrue nationally and at the local and regional levels".

DellaSala *et al.* [15] also states that "the roaded, intensively managed landscapes of the other national forest lands have been closely correlated with heavily sediment-laden streams and dramatic changes in flow regimes (Espinosa et al. 1997; Trombulak and Frissell 2000; Center for Biological Diversity et al. 2001; Coffin 2007; Frissell and Carnefix 2007). The small roadless areas that have been left "unmanaged", with a dearth of logging and roads, play a critical role in maintaining high-quality water and protecting aquatic ecosystems. The clean water from remnant roadless areas is important to maintain healthy coldwater salmonid fisheries, sustain viable aquatic ecosystems, and help protect threatened species and ecosystems (Abell et al. 2000; Trout Unlimited 2004). Roadless area are an important refugia for many salmon and trout populations, as well as for a diversity of endangered freshwater species (Henjum et al. 1994; Huntington 1998; Trombulak and Frissell 2000; CBD et al. 2001; Strittholt and DellaSala 2001; Oechsli and Frissell 2002; Strittholt et al. 2004; Petersen 2005)."

DellaSala et al. [15] state that "restoration of salmon and trout fisheries in places with high road densities will likely fail without the pivotal role provided by roadless areas as fishery strongholds." Further, they state that "For many major drainages (entire watersheds of major rivers, such as the Columbia River Basin), roadless areas and other wilderness areas represent the last few percentages (typically 1% to 5%) of the landscape with a minimally disturbed, or near natural, hydrology."

Frissell and Carnefix [17] report that "Roadless areas can be small and fragmented but can accrue to a large fraction of critical landscape. In the Upper Missouri Basin in Montana, within the 37% of the landscape with watersheds classified as highest value for freshwater conservation, almost one-half occurs within unprotected federal roadless areas; just 7% is inside wilderness and parks. In western

Montana, bull trout *Salvelinus confluentus* abundance increases with watershed roadless proportion. Roadless lands tend to occupy middle to lower elevations compared to protected Wilderness, where they more directly interface with high-value fish habitat; a Montana statewide "fine-filter" assessment revealed remarkably high occurrence of native trout populations associated with roadless areas, even within watersheds that are otherwise compromised. Most roadless areas contain steep lands with expanses of erosion-prone soils. We conclude that the value of roadless areas for native trout and biodiversity conservation continues to receive insufficient evaluation and disclosure in roadless policy debates and decisions."

Undeveloped areas are always under pressure from extractive development. We assert, rather than more management and more treatment, that these undeveloped areas be left alone. There is no need for the ONF to add new roads to harvest this area, and such disturbances increase all the harmful activities caused by logging and roads such as soil compaction, erosion, displacement of wildlife, fragmentation of habitat, the spread of noxious and invasive weeds, the increased risk of wildfires from human ignitions (90% of wildfires are caused by human activity), loss of carbon storage, and loss of biodiversity. The ONF must leave this area untouched, as such areas are increasingly rare and more valuable every year.

From these reported scientific observations from diverse authors, we conclude that commercial logging or thinning treatments, and additional roads in the undeveloped area will cause considerable harm to other natural resources including fish and wildlife habitats and water quantity and quality. While 61651 states "There is no forest, regional, or national direction or guidance for evaluating undeveloped lands" (p. 196), ONF should follow the precautionary principle[14] and the peer-reviewed science referenced above and avoid any actions on undeveloped lands.

Climate Change

There has been so much good scientific work done around climate change since 2019, we are a little concerned that the Purpose and Need statement of 61651 on page 2 focuses on the report by Halofsky, *et al.* [19]. We are glad to see that a few other, more recent, best available scientific reports are also cited in 61651.

The section of the Purpose and Need on Climate Change (pp. 3-4) provides an overview of actions that 61651 proposes as also presented in the overview of the Forest Service's Climate Adaptation Plan [11]. We encourage the ONF and the FS to respond to the national and global efforts to counter anthropogenic climate change, and support Executive Order 140721 [6]. The ONF must acknowledge that every effort from every agency and every person can help, or can hurt, the current and future habitability of this planet. We must all consider that even judicial systems are recognizing the impact of climate change on future generations, with a duty by governments to protect its citizens. ([12], [20])

61651 states that it "contributes to the goal of building resilience to climate change" through its action alternatives (p. 195). However, there is is much peer-reviewed science that confirms the No Action alternative will be better at sequestering carbon and offsetting anthropogenic climate change; see, for example, [10], [23], [46], [47], and [63]. We urge the ONF to use the precautionary principle[15] and to

14 Precautionary principle: https://en.wikipedia.org/wiki/Precautionary_principle
15 Precautionary principle: https://en.wikipedia.org/wiki/Precautionary_principle

plan to increase carbon sequestration for the benefit of both the present generation and future generations.

61651 does not increase new forests nor avoid damage to the forest. Rather, it is actively participating in removing maturing trees (up to 24.5 MMBF, p. 161), which contributes to carbon emissions and removes trees from the carbon sink. 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 [37]. 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. 61651 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. ([46])

Specific Recommendations

As users of our public lands, including our Ochoco National Forest, we work to protect what we see is most important, which is the long-term expression of Nature in these public forests. We, and many others, want to see a biodiverse ecosystem which adapts to environmental disturbances and changing climatic conditions, and from which we can continue to learn about the complexity and beauty of Nature and natural processes. We believe this is best done with minimal to no human management – passive management. And we have presented some of the current science to support our views.

We see that ONF and this 61651 project area are small parts of the larger, regional and even world-wide landscape, with interconnected atmospheric, water, faunal, and floral resources. We want to be a voice for Nature in protecting our natural resources.[16] We also understand that we are part of a larger political and economic context in which we must participate. With these understandings we present the following recommendations.

Timber and Forage

Looking at how we can 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, and currently, 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 61651, but it is stated that Alternative 2 will produce 24.5 MMBF and Alternative 3 18.1 MMBF (p. 161). While this is an extraction result for 61651, we fail to see if this is a sustainable amount and what future harvest projections may be anticipated or desired. This must also be balanced with the greater-good benefits of leaving the trees to sequester carbon and reduce the impacts of anthropogenic climate change, while also providing other ecosystem services.

61651 does state that "The Ochoco National Forest has offered 12-13 million board feet annually for the last 10 years. If the Ochoco National Forest offers 12 MMBF per year it can be assumed that a

16 Nature guardian: https://www.positive.news/economics/second-uk-company-appoints-nature-to-its-board/

sustainable yield of timber harvest, small tree thinning and fuels treatment would provide stability to industry employment, annual worker wages and private business revenue and investment." (p. 162) This assumption ignores the changing societal needs in the volatile international market for wood products. This does not indicate which project areas produce this timber or how much is expected from the 61651 project area and how production is distributed over future years. It also fails to make future projections and how climate change already necessitates reduction in timber harvests and puts greater value on carbon sequestration. Note that the Halofsky, *et al.*, report [19] also fails to discuss reducing timber harvests due to climate change. The FS as part of the USDA has always had resource extraction as a priority, but Executive Order 14072 [6] is an example of how government and society are (slowly) changing.

Commercial timber harvesting may be desired by the industry for many decades into the future as it develops new markets, such as the current expansion of the biomass market. With ongoing climate change and changing economic conditions, forecasting what is possible and what is profitable is difficult. What is not difficult is to see that reserving 50 percent of our landscape for carbon sequestration and natural processes by 2050 is an urgent priority [64]. Given this necessity, ONF should start now by reducing commercial harvesting in 61651 and across the whole forest.

Regarding forage, we urge ONF to reduce both the number of acres used for grazing and the intensity of grazing. Consider the concepts of silvopasture[17] to produce both timber and forage in a sustainable manner while leaving more of the forest open for natural ecosystem processes to fully function. While helping to reduce the number of AUMs on the landscape, such techniques could support both industries for a time, while also allowing more native wildlife across the landscape.

From this discussion it is obvious that forest management planning 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. We also need to analyze the cumulative effects of all harvesting (including the terms thinning and restoration) projects across the forest, including the economic impacts and how best to fill quotas for extractive public resources. The role of the ONF in national and global priorities 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 of the forest itself.

Overall Recommendations

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). [18] We ask the ONF to evaluate alternatives that better consider the health of the forest and the region over the long-term.

We understand there are restrictions to what we can recommend because of local community needs and wants. Changes to achieve necessary long-term goals and benefits are hard to accept in the short term.

17 https://en.wikipedia.org/wiki/Silvopasture

18 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.

In the spirit of looking at solutions that may be acceptable in the short-term, we understand we cannot consider some things, such as retiring grazing allotments.

We do recommend a project alternative with stronger environmental considerations that does the following:

- 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.
- Manages for more carbon sequestration, as this is a global priority.
- Manages to protect species of special concern and for migration routes.
- Takes no action on undeveloped areas except for road closures and cattle exclusion fences.
- 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).
- Reducing the impacts of grazing by reducing the number of AUMs on the allotments.
- More protection of riparian areas from cattle, roads, and human disturbance.

This DEA needs alternatives that explore ecologically sound options that avoid adverse environmental effects introduced by extensive commercial and non-commercial logging and thinning. 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 fragmentation caused by roads must be reduced by closing roads effectively. This is one highly used area of the ONF, and 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.

Another Alternative

We recommend the ONF develop a more ecosystem friendly alternative that uses lighter treatments of proposed commercial harvest and thinning, no cutting in the undeveloped lands, and many more road closures. We recommend an action alternative with reduced harvest activities, no new temporary roads throughout the project area and limited thinning and no commercial harvest in RHCAs, and no cutting any trees over 21 inches.

We ask the ONF to consider an alternative that:

- Maintains a small number of motorized transportation routes.
  - Using existing roads, a single East-West route and perhaps a couple North-South routes across the project area should be sufficient.
  - Minimize ML 2A roads (Administrative) and include them in road density calculations.
  - All other roads are physically closed to motorized traffic.
- Reduces commercial harvesting to below 10 MMBF and project only another 5 MMBF harvest in 100 years.
- Reduces non-commercial harvesting (thinning) to actions along transportation routes. Minimal cutting in discrete sections of riparian areas to create downed wood for stream habitat may be beneficial but must be limited. Natural tree death with raising ground water will create future large woody debris.
- Set aside more areas for recruitment of trees to LOS and Old-Growth stands.
- Analyzes for non-motorized trail, including non-technical mountain bike.
  - Mountain bike use in ONF continues to increase.
  - Possible part of a larger trail system that includes bike camping.
  - Hiking between riparian areas may provide a pleasant experience.
  - Hiking and biking across the varied ecological systems, scablands, Juniper woodland, dry forest, and riparian, is an educational opportunity. Include burned, harvested, and grazed areas as part of the education.
- Analyze for silvopasture techniques and reduce the number of AUMs.
- Exclude all motorized access to riparian areas.
- Eliminate cattle access to riparian areas.

The scabland and stringer habitat in this area has great potential for educational opportunities. Putting youth programs on this land to observe and work in the diversity of habitats could be very enlightening. Observing biodiversity across different soils and moisture regimes, and seeing all the life on even the dry scabland ecosystem, would increase appreciation for nature and what ONF has to offer the quiet recreationalist and biologist. This area also demonstrates aspects of geology, the impacts of grazing, and the actions of wildfire in the ecosystem. Youth programs could work on monitoring data collection, beaver analog dam construction, and other projects, and learn about this area as a small part of the Blue Mountain Ecoregion.

Closing

Overall, we find that the action alternatives presented in 61651 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[19], ensuring that a natural, biodiverse forest ecosystem will be functioning for future generations. Will our seventh generation[20] have a forest to enjoy, or will it be a tree plantation? Decisions for this project and others, and the cumulative effects across the whole forest will help determine that end condition.

Sincerely,

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

19 Public trust doctrine: https://en.wikipedia.org/wiki/Public_trust_doctrine
20 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] Barnett, Kevin, Carol Miller, and Tyron J. Venn. 2016. “Using Risk Analysis to Reveal Opportunities for the Management of Unplanned Ignitions in Wilderness.” *Journal of Forestry* 114 (6): 610–18. https://doi.org/10.5849/jof.15-111.

[5] Berner, Logan T, Beverly E Law, Arjan J H Meddens, and Jeffrey A Hicke. 2017. “Tree Mortality from Fires, Bark Beetles, and Timber Harvest during a Hot and Dry Decade in the Western United States (2003–2012).” *Environmental Research Letters* 12 (6): 065005. https://doi.org/10.1088/1748-9326/aa6f94.

[6] 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.

[7] 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.

[8] 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.

[9] 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.

[10] 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.

[11] “Climate Adaptation Plan.” 2022. FS-1196. Forest Service, USDA. https://www.usda.gov/sites/default/files/documents/4_NRE_FS_ClimateAdaptationPlan_2022.pdf.

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

[13] DellaSala, D. 2020. Senate Interim Committee on Wildfire Prevention and Recovery. January 14, 2020, hearing and public testimony. Geos Institute. https://geosinstitute.org/wp-content/uploads/2022/10/dellasalawildfirehearingcombined-1-14-20.pdf

[14] 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.

[15] DellaSala, D. A., J. R. Karr, and D. M. Olson. 2011. “Roadless Areas and Clean Water.” *Journal of Soil and Water Conservation* 66 (3): 78A-84A. https://doi.org/10.2489/jswc.66.3.78A.

[16] Egan, Timothy. 2009. *The Big Burn: Teddy Roosevelt and the Fire That Saved America*. Boston: Houghton Mifflin Harcourt. https://www.goodreads.com/book/show/6452538-the-big-burn.

[17] Frissell, Chris, and Gary Carnefix. n.d. “The Geography of Freshwater Habitat Conservation: Roadless Areas and Critical Watersheds for Native Trout.” https://www.academia.edu/download/78064426/47a2f9c3-1ae1-4ac0-a59d-5f79c59eadb8.pdf.

[18] 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.

[19] Halofsky, Jessica E., David L. Peterson, and Joanne J. Ho. 2019. “Climate Change Vulnerability and Adaptation in South-Central Oregon.” General Technical Report PNW-GTR-974. Forest Service, USDA. https://www.cabdirect.org/cabdirect/abstract/20193482521.

[20] 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/.

[21] Harmon, Mark E., Chad T. Hanson, and Dominick A. DellaSala. 2022. “Combustion of Aboveground Wood from Live Trees in Megafires, CA, USA.” *Forests* 13 (3): 391. https://doi.org/10.3390/f13030391.

[22] 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/.

[23] 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.

[24] Hutto, Richard L., Robert E. Keane, Rosemary L. Sherriff, Christopher T. Rota, Lisa A. Eby, and Victoria A. Saab. 2016. “Toward a More Ecologically Informed View of Severe Forest Fires.” Edited by F. Biondi. *Ecosphere* 7 (2): e01255. https://doi.org/10.1002/ecs2.1255.

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

[26] Johnson, K. Norman, Jerry F. Franklin, Gordon H. Reeves, Debora L. Johnson, and Susan Jane M. Brown. 2023. *The Making of the Northwest Forest Plan: The Wild Science of Saving Old Growth Ecosystems*. Corvallis, Oregon: Oregon State University Press.

[27] 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.

[28] 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.

[29] Kaminski, Isabella. 2023. “What Would Nature Say? Second UK Company Appoints the Natural World to Its Board.” Positive.News. November 21, 2023. https://www.positive.news/economics/second-uk-company-appoints-nature-to-its-board/.

[30] 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

[31] Keeley, Jon E., and Alexandra D. Syphard. 2021. “Large California Wildfires: 2020 Fires in Historical Context.” *Fire Ecology* 17 (1): 22. https://doi.org/10.1186/s42408-021-00110-7.

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

[33] 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.

[34] 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.

[35] 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.

[36] 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.

[37] Law, Beverly, and William R. Moomaw. 2021. “Keeping Trees in the Ground Where They Are Already Growing Is an Effective Low-Tech Way to Slow Climate Change.” February 23, 2021. https://theconversation.com/keeping-trees-in-the-ground-where-they-are-already-growing-is-an-effective-low-tech-way-to-slow-climate-change-154618.

[38] 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.

[39] Loucks, Colby, Nicholas Brown, Andrea Loucks, and Kerry Cesareo. 2003. “USDA Forest Service Roadless Areas: Potential Biodiversity Conservation Reserves.” http://www.consecol.org/vol7/iss2/art5.

[40] 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.

[41] MacKenzie, William H., and Jennifer R. Moran. 2004. *Wetlands of British Columbia: A Guide to Identification*. Land Management Handbook 52. Victoria, BC: British Columbia, Ministry of Forests, Forest Science Program.

[42] 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.

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

[44] 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.

[45] 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.

[46] 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.

[47] ———. 2023. “Protect Large Trees for Climate Mitigation, Biodiversity, and Forest Resilience.” *Conservation Science and Practice*, April, e12944. https://doi.org/10.1111/csp2.12944.

[48] 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

[49] 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.

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

[51] 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.

[52] *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/.

[53] Pollock, Michael M., Timothy J. Beechie, and Hiroo Imaki. 2012. “Using Reference Conditions in Ecosystem Restoration: An Example for Riparian Conifer Forests in the Pacific Northwest.” *Ecosphere* 3 (11): 1–23. https://doi.org/10.1890/ES12-00175.1.

[54] 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.

[55] 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.

[56] 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.

[57] 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.

[58] Schoennagel, Tania, Jennifer K. Balch, Hannah Brenkert-Smith, Philip E. Dennison, Brian J. Harvey, Meg A. Krawchuk, Nathan Mietkiewicz, et al. 2017. "Adapt to More Wildfire in Western North American Forests as Climate Changes." *Proceedings of the National Academy of Sciences* 114 (18): 4582–90. https://doi.org/10.1073/pnas.1617464114.

[59] 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.

[60] *Science News*. 2006. "Global Warming May Warrant New Approaches To Ecosystem Restoration," June 15, 2006. https://www.sciencedaily.com/releases/2006/06/060615082745.htm.

[61] 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.

[62] 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.

[63] 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.

[64] Wilson, Edward O. 2016. *Half-Earth: Our Planet's Fight for Life*. First edition. New York: Liveright Publishing Corporation, a division of W.W. Norton & Company. https://www.goodreads.com/book/show/25622872-half-earth.