Friends of the Clearwater
Keeping Idaho's Clearwater Basin Wild
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October 23, 2023

Transmitted via online project portal at:
https://cara.fs2c.usda.gov/Public/Commentinput?project=43661

Objection Reviewing Officer
USDA Forest Service Northern Region
Attn: Hungry Ridge Restoration Project
26 Fort Missoula Road
Missoula, MT 59804

Objection Reviewing Officer:

Pursuant to 36 C.F.R. 218, Friends of the Clearwater (FOC), Alliance for the Wild Rockies (AWR) and WildEarth Guardians file this objection to the September 2023 Final Supplemental Environmental Impact Statement (hereinafter FSEIS or FEIS) and Draft Record of Decision (ROD) for the Hungry Ridge Restoration project. This timber sale is proposed for the Salmon River Ranger District of the Nez Perce National Forest (a portion of the administratively combined Nez Perce-Clearwater National Forests). The Responsible Official is Forest Supervisor Cheryl Probert.

Attachments, references, and other incorporated documents we haven't already provided to the Hungry Ridge ID Team are included on the data CD with the version sent to the Forest Service via US mail postmarked this date.

The ROD and FEIS describe the selected Alternative 2-modified:

* Use commercial timber harvest as a tool to treat forested vegetation and reduce fuels on approximately 7,164 acres: …intermediate harvest on approximately 1,959 acres …regeneration harvest on approximately 5,205 acres.
*Conduct prescribed burning on approximately 12,372 acres. Use prescribed fire to treat natural fuels on approximately 9,495 acres and all activity residual fuels left from timber harvest operations on approximately 2,877 acres.
* Construct less than 9 miles of permanent road (specified) for long term use.
* Construct approximately 23 miles of temporary roads to facilitate harvest and decommission no later than three years after the project is completed. …Of the temporary roads, 3 miles will be constructed over previously recontoured roads, 5 miles will be on a previously abandoned road, and 1 mile over a road designated for off road motorized use.
* Perform approximately 67 miles of road maintenance, previously described and analyzed in the Final EIS, Chapter 2, as reconstruction, reconditioning or maintenance.

The FSEIS describes the Forest Service's proposed destruction of old growth: "Alternative 2 proposes the most treatment in old growth on approximately 954 acres… . In Forest Plan Old Growth, Alternative 2 proposed regeneration harvest on approximately 409 acres and 188 acres of intermediate harvest. …In Replacement Old Growth, Alternative 2 proposed regeneration harvest on approximately 312 acres and 45 acres of intermediate harvest."

We incorporate all of our previous comments, objections, and other letters to the Forest Service (FS) pertaining to this project, including the Run of the Mill timber sale. We also incorporate the comments and objections of Harry Jageman within this objection. With some exceptions, the ID Team already has all those documents.

FOREST SERVICE ENGAGES IN FLAWED AND PERFUNCTORY NEPA PROCESS

Obvious from the way the FS asserts an overly narrow scope of the Supplemental EIS and in its failure to genuinely consider public comments on the Draft Supplemental EIS and properly weigh scientific information provided by the public in comments (see next section), the agency demonstrates a deep disdain for the public and the laws governing management of our shared public lands.

Now, the FS publishes a Draft Record of Decision without withdrawing or otherwise acknowledging the illegitimacy of its previous ROD following a federal court enjoining its implementation as authorizing an illegal project. This new Draft ROD indicates it would not be the same as the previous ROD, so why is the FS holding onto it?

Furthermore the FS has not cancelled the Run of the Mill timber sale, which was awarded before the Court injunction. This strongly biases the FSEIS and skews the NEPA process.

In announcing the availability of the Draft Supplemental Environmental Impact Statement **(**DSEIS) the District Ranger wrote in his March 6, 2023 letter: "The Draft SEIS has been prepared to further evaluate old growth and cumulative effects to old growth under National Forest Management Act (NFMA) and National Environmental Policy Act (NEPA) consistent with Case No. 3:21-cv-00189-CWD Memorandum and Decision Order (June 24, 2022)." That same letter goes on to state:

> **At this time, I am asking for comments specifically on information presented in this Draft SEIS.** … The Draft SEIS presents the old growth verification and old growth cumulative effects analysis (and) supplements the effects to old growth documented in the Hungry Ridge Restoration Project Final Environmental Impact Statement (Final EIS) alternatives, as presented in September 2020. …**While all comments will be accepted, those focused to the new information within the Draft SEIS will be the most helpful at this time**. …

(Emphases added.) But as our DSEIS comment stated, "under the CEQ's NEPA regulations, the FS is also required to prepare and release for public comment a supplemental EIS when there are 'significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.' 40 C.F.R. § 1502.9(c)(1)(ii)." The FS disregards all indications that there is new information to consider beyond their narrowly defined old-growth issue. This is exemplified where our DSEIS comments state:

> Following the March 25, 2020 dismissal of our Objection we have observed an influx of new documents placed on the Hungry Ridge project website, including a Revised Final EIS dated September 2020, and documents placed as recently as the last week in February, 2021.
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> In a September 14, 2020 letter to the Nez Perce Tribal Executive Committee, Forest Supervisor Probert stated:
>
>> With consideration of comments from you and your staff, I have prepared the Hungry Ridge Restoration Project, Final Environmental Impact Statement (Final EIS) – September 2020. The Final EIS and project record have been updated based on the objection points from the Tribe; watershed, fisheries and wildlife analysis.

So following the final steps of the previous NEPA process, the FS has added or changed much documentation regarding the Hungry Ridge project. Yet the FS wants to hear no public feedback on that. As the FSEIS states in responding to public comments on the DSEIS, "The Draft SEIS presents only supplemental information on old growth." This violates NEPA.

Add to this situation the complete failure of the FS to respond to several of our comments on the original Draft EIS, as pointed out in our original Objection. The FS has made no attempt whatsoever to rectify this or respond genuinely. This also violates NEPA.

Yet old growth itself is not the narrow subject matter the FS portrays. Examining some background on the subject illustrates this. The 1987 Nez Perce Forest Plan Final EIS at III-35 states, "Wildlife species are dependent on the amount and distribution of old-growth forest… ." It continues:

> Habitat diversity is a measure of the variety, distribution, and structure of plant communities as they progress through various stages. Each stage supports different wildlife species. **One of the most critical elements of diversity in a managed forest is old growth. If sufficient old growth is retained, all other vegetative stages from grassland through mature forest will be represented in a managed forest**.

(Id., emphasis added.) The Forest Plan FEIS goes on to mention old growth in several other instances, including in discussions of the habitat needs of several species of wildlife found on the Forest. The FS's entire notion that the scope of a supplemental EIS in regards to old growth can be narrow is highly flawed. The agency is proposing to clearcut and otherwise damage or destroy hundreds of acres of old growth, so as the Forest Plan FEIS acknowledges, the ramifications beyond those specific stands are profound. Our DSEIS comments cite Juel (2021)[1] which discusses old growth from ecological, regulatory, historical, and other perspectives. In response

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[1] Juel (2021) cites many scientific references and FS documents, presenting a science- and experiential-based discussion of old growth.

the FS says, "Non peer reviewed article. The comment originated in the response to the Clear Creek project and focuses on the definition of Green et al for defining old-growth." On the contrary, in citing that document our comments stated:

> Stands of trees meeting old-growth criteria are a part of **old-growth ecosystems** as recognized in the above quote from the Forest Plan Final EIS, as stated in the FS's Green et al, and as discussed in Juel (2021) including the scientific sources cited therein. In its extremely narrow scope the DSEIS violates NEPA because changes in what the FS considers to be old growth, where it is located, and how much exists on the NPNF and in the HR project area have implications for NEPA analyses for practically all other ecosystem components and processes (Juel, 2021 and the scientific sources cited therein).

The paper was never intended for peer review, but cites literally dozens of sources, the vast majority of them written by the FS and/or peer reviewed. And a pdf of each of those cited documents was provided to the FS on data disk along with our comments on the DSEIS. The FS's response to this particular comment exemplifies that it cannot competently address public comments.

In response to multiple aspects of our comment letter, the FSEIS states, "The Draft SEIS presents only supplemental information on old growth" and avoids addressing our comments' content. Yet from its responses to other comments, it's obvious that the FS is selective in the enforcement of its narrow scope. For example in response to our cite of "Millar, C. I. & Stephenson, N. L. Temperate forest health in an era of emerging megadisturbance. Science 349, 823–826 (2015)" the FS goes on to state how the reference supports the FS's position even though it is not about old growth.

And in regards to a piece written by retired Forest Service Deputy Chief James Furnish ("Where the Wildfire Conversation is Headed" Sept. 2022) the FS responds, "Not considered. This is an opinion and not peer reviewed. Yet the FEIS is sprinkled throughout with so many FS opinions lacking proper support from a scientific perspective. The FS prefers to ignore all but its own opinions.

Requested Remedy:
Please refrain from dragging the public through yet another flawed process and simply choose the No Action Alternative. It's the only FEIS alternative that wouldn't destroy thousands of acres of wildlife habitat and is closest to being consistent with best available scientific information.

BOTCHED RESPONSE TO PUBLIC COMMENTS ON DRAFT SUPPLEMENTAL EIS

In the FSEIS, the FS includes "APPENDIX F – FOREST SERVICE RESPONSES TO PUBLIC COMMENTS ON THE DRAFT SEIS." In FEIS Appendix F the FS goes about its usual non-acknowledgement of perspectives differing from its own, and ignores of much of the important substance and nuance expressed in comments. And in the FSEIS Appendix F section "Consideration of Science and Literature Submitted by the Public" (Table F-3) the FS resorts to distorting and mischaracterizing DSEIS comments, revealing an agency incapable of interpreting and applying scientific information.

The very first reference listed in Table F-3 is Achat et al. (2015). Therein the FSEIS states, "This reference was given by commenters, but they did not provide specific reasons or context for the team to evaluate." Apparently it was not enough for us to state in our DSEIS comments, "Achat et al., 2015 has estimated that intensive biomass harvests could constitute an important source of carbon transfer from forests to the atmosphere. Pacific Northwest forests hold live tree biomass equivalent or larger than tropical forests (Law and Waring, 2015)."

The same goes for another reference cited in our DSEIS comments—Birdsey et al. (2023): "This reference was given by commenters but they did not provide specific reasons or context for the team to evaluate." (FSEIS Table F-3.) On the contrary, our DSEIS comments state, "In a January 12, 2023 News Release, scientists (Birdsey et al., 2023) point out that 'Mature Federal Forests Play an Outsized Role in the Nation's Climate Strategy.'" We then provide a quote from a news release issued by those scientists:

> A new study published in the peer-reviewed journal Forests and Global Change presents the nation's first assessment of carbon stored in larger trees and mature forests on 11 national forests from the West Coast states to the Appalachian Mountains. This study is a companion to prior work to define, inventory and assess the nation's older forests published in a special feature on "natural forests for a safe climate" in the same journal. Both studies are in response to President Biden's Executive Order to inventory mature and old-growth forests for conservation purposes and the global concern about the unprecedented decline of older trees.

The FS exhibits the same difficulty perceiving "reasons" and misses obvious "context" for the following additional references cited in our DSEIS comments: CEQ Guidance (2016), DellaSala (2022), DellaSala, et al. (2023), Harmon et al, (2022), Harris et al (2016), Hutto (2022), IPCC (2014), Law and Waring (2015), Law et al. (2018), Law et al. (2022), Law and Moomaw (2023), Millar et al. (2007), NatureServe (2023), and Stockmann et al. (2014).

FSEIS Table F-3 says of Breshears et al. (2005), which our DSEIS comments cite: "The copy of the article supplied by the commenter was incomplete and contained only charts and graphs." We only have one version[2] of Breshears et al. (2005) and it's complete.

For some references it lists, FSEIS Table F-3 states, "Unable to locate literature from citation given in comments. Reference or full citation was not provided." This is in regards to the following: Geist 1982; Leckenby 1984; Parker and Robbins 1984; Oregon Department of Fish and Wildlife-personal communication, Peek and others 1982; Schwartz 2007; and Thomas and others (1979). This indicates another aspect of the FS's inability to read scientific research writing. In each case, our comments were citing from another scientific reference we provided to the FS. The authors of those articles, as is common in scientific research publication, were themselves citing other scientific sources. That the FS is unable to recognize internal citations is head-scratching.

[2] We are confident in that statement because we keep an exact duplicate of the data disk provided to the FS as part of our comments on the DSEIS.

What FSEIS Table F-3 says about Lyon et al (1985), Mattson (2021) Marcot et al. (1991), Proctor et al (2017), Ranglack et al. (2017) and USDA Forest Service (1990) is: "The commenter is not specifically asking us to review this reference." Why do you think you were given a copy of those articles on the data disk?

This might be humorous except the FS is proposing to clearcut thousands of acres (including old growth) and construct many miles of new roads while claiming such activities are consistent with good stewardship and best available science.

FSEIS Table F-3 says for Scientists Letter (2022), "Unable to locate literature from citation given in comments. No specific reference was made." To be clear, our DSEIS comments stated:

> In 2022 over 90 scientists working at the intersection of ecosystems and climate change sent a letter to Canada's Prime Minister Justin Trudeau. They state:
>
>> When primary forests, whether in Canada or elsewhere, are logged they release significant amounts of carbon dioxide, exacerbating climate change. Because primary forest ecosystems store more carbon than secondary forests, replacing primary forests with younger stands, as Canada is doing, ultimately reduces the forest ecosystem's overall carbon stocks, contributing to atmospheric greenhouse gas levels.
>>
>> Even if a clearcut forest eventually regrows, it can take over a decade to return to being a net absorber of carbon, and the overall carbon debt in carbon stocks that were removed from older forests can take centuries to repay, a luxury we simply no longer have. Recent studies also indicate that soil disturbance associated with logging results in large emissions of methane (CH_4), a powerful greenhouse gas second only to CO_2 in its climate forcing effects.

FSEIS Table F-3 says for Bollenbacher and Hahn, 2008: "Document could not be located on disk provided." At no time after receiving our comments did the FS contact us about this. If they had, we would have replied, "It's there—look inside the folder entitled Juel_2021." It was also cited in our original Objection to this project, and was given to the FS on data disk at that time.

Please note that five other references FSEIS Table F-3 identifies as missing from our submission are being provided as part of this Objection. We would have been happy to do this as soon as the FS noted the omission and contacted us, but the FS's responses in the FSEIS is the first we've been notified.

Requested Remedy:
Please consult independent scientific experts for the purpose of conducting a science consistency review of the analyses presented in the FSEIS/FEIS, as we discussed in detail in the section on Scientific Integrity of our original Objection (e.g., p. 74).

TRAVEL MANAGEMENT

The FS describes Alternative 2-modified in part, "Construct approximately 23 miles of temporary roads to facilitate harvest and decommission no later than three years after the project is completed." This is nonsense, because the project is not completed until temporary roads are decommissioned.

Remedy: Identify the situation that starts this 3-year clock ticking, for each "temporary" road if necessary.

OLD GROWTH AND OLD-GROWTH ECOSYSTEMS

The FSEIS ignores practically all of the dozens of pages of our DSEIS comments on the interrelated topics of old growth, climate change, wildlife habitat, ecological resilience, fire ecology and fire policy, and we don't repeat it in this objection.

We incorporate the discussion (below) on old-growth Management Indicator Species within this section.

Old growth is very important because it provides unique habitat conditions for wildlife, plants, fungi and other life forms which are not well-represented in younger or managed forests. Old growth provides reserves of biological diversity typically depleted in intensively managed stands. This is reflected in the Forest Flan definition of old growth:

> A community of forest vegetation which has reached a late stage of plant succession characterized by a diverse stand structure and composition along with a significant showing of decadence. The stand structure will have multistoried crown heights and variable crown densities. There is a variety of tree sizes and ages ranging from small groups of seedlings and saplings to trees of large diameters, exhibiting a wide range of defect and breakage both live and dead, standing and down. The time it takes for a forest stand to develop into old-growth condition depends on many local variables such as forest type, habitat type, and climate. Natural chance events involving forces of nature such as weather, insect, disease, fire, and the actions of man also affect the rate of development of old-growth stand conditions. Old-growth stand refers to a stand of timber that, generally, meets the following criteria:
>
> 1. At least 15 trees per acre greater than or equal to 21 inches diameter at breast height (DBH). Providing trees of this size in the lodgepole pine and sub-alpine fir stands may not be possible.
> 2. Two or more canopy layers.
> 3. At least .5 snags per acre greater than or equal to 21 inches DBH and at least 40 feet tall.
> 4. Signs of rot and decadence present.
> 5. Overstory canopy closure of 10-40 percent; understory canopy closure of at least 40 percent; total canopy closure at least 70 percent.
> 6. Logs on the ground.

Bollenbacher and Hahn, 2008g state:

> Relative to harvested forests, OG stands had higher species richness (Mazurek and Zielinski 2004; birds: Beese and Bryant 1999), supported more small mammal individuals

and biomass (Rosenberg and Anthony 1993; Carey 1995; Carey and Johnson 1995), and allowed for greater movement and genetic diversity (tailed frog *Ascaphus truei*: Wahbe et al. 2004, 2005).

> …Related studies examining wildlife responses in OG stands compared to younger stands revealed extensive variability, which may be attributed to differences among studies in location; stand type, treatment and size; and pre- and post-treatment stand conditions. Clearly, more work is needed; in particular, we need to rigorously investigate OG treatment effects on forest structure and composition and wildlife populations in the Northern Region.

But in its new old growth analysis, the FS ignored most of the Appendix N factors for what counts as old growth. Appendix N defines "old-growth habitat" as "a community of forest vegetation which has reached a late stage of plant succession characterized by a diverse stand structure and composition along with a significant showing of decadence." It further defines an "old-growth stand" as generally meeting six criteria:

1. At least 15 trees per acre > 21 inches diameter at breast height (DBH). . . .
2. Two or more canopy layers.
3. At least .5 snags per acre >21 inches DBH and at least 40 feet tall.
4. Signs of rot and decadence present.
5. Overstory canopy closure of 10-40 percent; understory canopy closure of at least 40 percent; total canopy closure at least 70 percent.
6. Logs on the ground.

But as stated in Section K.2 of our comments on the DSEIS, FS meeting notes show that for the SEIS, the FS evaluated old growth as defined by the Forest Plan (FPOG) by considering only 2 factors from Appendix N: the number of trees per acre greater than 21" dbh and the number of snags per acre greater than 15"dbh. The FS ignored the other four factors. In its response to comments, the FS did not even address this specific issue.

Second, the FS did not follow the explicit requirements in Appendix N for how to determine whether a "block" or "complex" of forest stands counts as existing or replacement old growth, and how much of each. Appendix N directs:

> Where available, stands should be at least 300 acres. Next best would be a core block of 150 acres with the remaining blocks of no less than 50 acres and no more than 1/2 mile away. If existing old-growth blocks are less than 100 acres, the stands between the old-growth blocks should be designated old-growth replacement. The entire unit consisting of old-growth blocks and replacement old growth should be managed as an old-growth complex. If the old-growth component is less than 50 percent of the complex, the complex should be considered replacement old growth. Within the old-growth complex, only the stands that meet old-growth criteria will be counted toward meeting the allocation for existing old growth. The replacement stands will be counted toward meeting the allocation for replacement old growth.

In Section K.2 of our comments on the DSEIS, we warned that the FS does not appear to have followed these requirements. We still do not see where or how the FS identified complexes of stands, or how the FS considered whether any particular complex contained more or less than 50% old growth stands before determining whether any of the complex could be counted to include old growth. And for any such complexes with at least 50% old growth, we still do not see where or how the FS then counted only the stands within the complex that qualify as old growth towards its FPOG numbers, while counting non-qualifying stands in the complex as replacement old growth as defined by the Forest Plan (ROG). In its response to comments, the FS did not even address this specific issue.

Third, in Section K.2 of our comments on the DSEIS, we noted that comparing the old growth maps show that some areas which the FS previously determined in the EIS qualified as North Idaho Old Growth (NIOG) only (and did not qualify as FPOG) are now found in the SEIS to qualify as FPOG. As an example, in the southwest corner of OGAA03050102, the SEIS shows a large area of FPOG that was previously found to be NIOG only in the earlier EIS. But the FS has not explained in its response to comments or in the record why these areas that were previously not qualified to count as FPOG now count as FPOG.

In our DSEIS comments subsection headed "**Hungry Ridge project area old growth**" we pointed out that the DSEIS and Updated Old Growth Analysis (UOGA) do not reconcile significant changes in the amount of Forest Plan Old Growth (FPOG) from the FEIS to the DSEIS. The FSEIS did not directly respond to that comment. It does state:

> Please see the data collection protocol in the NPCLCommonStand Exam Protocol document for methods for old-growth data collection and analysis based on the Forest Plan and the Federal Court's ruling.
>
> The assertion that the Forest relied only on remotely sensed data is incorrect. Stand exam data collected and method of collection for this analysis are described in Project Record. Please reference the field collected data in the project record.

However, the "NPCLCommonStand Exam Protocol document" was not placed on the project website for the public to access. This is consistent with of the FS's acting like it's top secret, which FOC first experienced in 2020 upon requesting to meet with the Forest Supervisor and the FS's qualified experts regarding its opaque old-growth inventory and methodology. Ultimately the Supervisor refused to cooperate. This is documented in "OG FOIA 2020-03332 Final Response.pdf", a letter "OG Meeting Request.docx", our notes "OG Meeting notes6-11-20.docx" and email string "Re_ Meeting Request_email 6-15-20.pdf" which are being submitted as part of this objection. Until this unacceptable attitude by Forest leadership changes, environmental interests will continue to perceive NPCNF officials as untrustworthy and see litigation as the only option. We emphasize that it's the agency's own choice to force citizens to use the courts to get answers to questions about publicly owned old-growth forests and access related public agency data.

Fourth, we also warned in Section K.7 our comments on the DSEIS that the FS relied too heavily on remote and old data, and failed to gather sufficient up-to-date field data to identify FPOG at Hungry Ridge.

To summarize, the FS appears to have cut corners to quickly reapprove the Hungry Ridge project without gathering sufficient information and without considering the appropriate factors under Appendix N. This violates NEPA by failing to gather critical baseline information on old growth presence as required to take a hard look at impacts to old growth and old growth dependent species and ecosystems. NEPA requires that federal agencies prepare an EIS for major federal actions significantly affecting the quality of the human environment. 42 U.S.C. § 4332(2)(C). This obligates agencies to "carefully consider" a project's potential environment impacts and ensure "relevant information will be made available," so that the public can "play a role in both the decisionmaking process and the implementation of that decision." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989). This also violates NFMA by failing to comply with the Forest Plan requirement to maintain a minimum of at least 5% FPOG in each Old Growth Analysis Area (OGAA). NFMA and its implementing regulations require that all management actions must be consistent with the governing forest plan. 16 U.S.C. § 1604(i); 36 C.F.R. § 219.10(e). "It is well-settled that the Forest Service's failure to comply with the provisions of a Forest Plan is a violation of NFMA." *Native Ecosystems Council v. U.S. Forest Serv.*, 418 F.3d 953, 961 (9th Cir. 2005).

Old Growth: Failure to Comply with Forest Plan Appendix N Requirement to "Designate" Replacement Old Growth at Hungry Ridge

Appendix N requires that the FS maintain at least 5% "existing old growth" in each OGAA, and the FS must also "designate" at least another 5% "replacement old growth" in each OGAA. In Section K.2 of our comments on the DSEIS, we warned the FS must clearly "designate" replacement old growth and maintain it in a durable, publicly available inventory. In response to comments, the FS never addressed this specific issue. While the DSEIS and Final SEIS identify areas found to qualify physically as ROG, we still do not see how the FS has complied with the Appendix N requirement to "designate" at least 5% of each OGAA as ROG. Without designating these areas, there is no assurance they will mature into FPOG over the years.

Old Growth: Undercounting the Amount of FPOG and Replacement Old Growth that Will be Lost Due to Project

Even accepting the FS's identification of FPOG and ROG, the FS has violated NEPA and NFMA by undercounting the amount of existing FPOG and ROG that will no longer qualify as such after the Hungry Ridge Project. The FS misleadingly and/or incorrectly claims that after regeneration logging and intermediate logging in stands of FPOG and ROG, those stands will still qualify as FPOG and ROG.

With respect to regeneration techniques, our comments and objections on the FS's prior approval of the Hungry Ridge and End of the World Projects explain how all regeneration logging techniques approved here--even if they leave a sufficient number of large trees in place to meet one of the many FPOG criteria--will not result in FPOG, because of the lack of many other

FPOG characteristics. Similarly, Harry Jageman's DSEIS comments include: "Stands with intermediate logging treatments are unlikely to qualify as old growth once the logging is complete." In response, the FS writes: "Thank you for your opinion. The Forest is following the Forest Plan definition of old-growth. Intermediate treatments in old-growth are designed to maintain a fully stocked stand that maintains the characteristics of old-growth." The FS can cite no previous results indicating it has conducted "intermediate" or other intensive logging in old growth during Forest Plan implementation and maintained "a fully stocked stand that maintains the characteristics of old-growth." In truth, even "intermediate" harvests result in highly sanitized forest that lack many of the FPOG criteria and other ecologically relevant factors for what counts as old growth. The Forest Plan was written under the expressed assumption that maintaining old growth to meet Forest Plan requirements means identifying it, designating it for meeting minimum requirements, and leaving it unmanaged.

As a result, the FS has undercounted the amount of FPOG and ROG that will be lost under each of the action alternatives, in violations of NEPA's hard look requirement, and in violation of NFMA's requirement to demonstrate compliance with the Forest Plan's 5% minimum requirements for FPOG and ROG.

Old Growth: Failure to Demonstrate Compliance with Forest Plan Appendix N Requirement to Maintain Minimum 10% Old Growth Forest-Wide

As stated in Section K.3 of our comments on the DSEIS, the FS has not complied with the Court's order or the Forest Plan Appendix N's requirement to demonstrate that it is maintaining at least 10% FPOG throughout the Nez Perce National Forest. Appendix N requires: "to maintain a viable population of old-growth-dependent species, it is necessary to maintain 10 percent of the total forested acres as old growth." The FS claims to meet this, but the data and methods used are arbitrary and capricious and violate NEPA and NMFA.

First, like with identifying FPOG at Hungry Ridge, the FS considers only 1 or 2 of the 6 FPOG criteria when it estimates forest-wide old growth, ignoring the other criteria. Page 13 of Chapter 3 of the SEIS states: "The Forest Inventory and Analysis (FIA) data analyzed by Reyes and Morgan (2022) shows that approximately 22.5 percent of the Nez Perce National Forest meets the Forest Plan definition of old growth (minimum of 15 trees per acre greater than 21 inches diameter breast height (dbh)) (90 percent confidence interval: 19.7 – 25.4 percent). The data also shows approximately 14.7 percent of the Nez Perce National Forest meets the Forest Plan definition of old growth (minimum of 15 trees per acre greater than 21 inches dbh, and vertical structure equal to 2, 3 or continuous) (90 percent confidence interval: 12.4 – 17.0 percent). The number of FIA plots used was 343. Based on this information, the Nez Perce National Forest is above the Forest Plan minimum standard of 10 percent old growth forest wide." Had the FS considered other criteria beyond just 2 of the 6, there could be significantly less old growth than 14.7 percent forest-wide. But the FS did not utilize those other criteria, and did not offer any estimate as to how many of these areas that meet 2 of the 6 criteria are likely to meet other criteria as well.

Second, the FS relies on FIA plot data, but this violates NEPA. As explained in Section K.3 of our comments, FIA data is essentially a black box. The public has no idea what plots are used and has absolutely no way to verify any of the information or analysis the FS relies on using FIA data. In fact, the FS itself admits it does not know where the FIA plots are either, making it impossible for the FS to confirm which plots actually meet FPOG criteria and how representative the plots are across the entire Nez Perce National Forest.

Third, like with identifying FPOG at Hungry Ridge, the FS's forest-wide estimates of FPOG do not comply with the specific instructions in Appendix N for identifying "blocks" and "complexes" and explaining how to count old growth. Again, Appendix N directs: “Where available, stands should be at least 300 acres. Next best would be a core block of 150 acres with the remaining blocks of no less than 50 acres and no more than 1/2 mile away. If existing old-growth blocks are less than 100 acres, the stands between the old- growth blocks should be designated old-growth replacement. The entire unit consisting of old-growth blocks and replacement old growth should be managed as an old-growth complex. If the old-growth component is less than 50 percent of the complex, the complex should be considered replacement old growth. Within the old-growth complex, only the stands that meet old-growth criteria will be counted toward meeting the allocation for existing old growth. The replacement stands will be counted toward meeting the allocation for replacement old growth.” Nowhere does the FS show how its forest-wide estimates of old growth followed these specific directives from the Forest Plan.

Old Growth: SEIS fails to consider best available science and wide range of societal values concerning old growth

Nothing in the FEIS acknowledges the wide range of values held by citizens regarding our old-growth forest legacy. Lee, 2009[3] expresses important public sentiments the FS ignores:

> The birth of “old growth” as the iconic forest can be encapsulated in a few words describing social meanings, time and space: re-enchantment trumped rationality; the eternal present absorbed the chronology of forest growth; mystical places colonized the choreography of sustained yield operations.

We find nothing in the FEIS/FSEIS discussion on old growth that recognizes such societal values. In 1989, Forest Service Chief Dale Robertson issued a “Position Statement on National Forest Old Growth Values” (Chief’s Position Statement – see Green et al., 1992). The Chief’s Position Statement began, “The Forest Service recognizes the many significant values associated with old growth forests, such as biological diversity, wildlife and fisheries habitat, recreation, aesthetics, soil productivity, water quality, and industrial raw material. Old growth on the National Forests will be managed to provide the foregoing values for present and future generations. …Where goals for providing old growth values are not compatible with timber harvesting, lands will be classified as unsuitable for timber production.”

The 1989 Chief’s Position Statement included steps national forest managers were to take to reflect this range of old growth values. The direction included:

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[3] Provided to FS on data disk along with our DSEIS comments or along with our original Objection. Please note that cites in this Objection appearing in red text were likewise previously provided to the FS in one of those two instances, sometimes in the Juel_2021 folder.

- Old growth values shall be considered in designing the dispersion of old growth. This may range from a network of old growth stands for wildlife habitat to designated areas for public visitation. In general, areas to be managed for old growth values are to be distributed over individual National Forests with attention given to minimizing the fragmentation of old growth into small isolated areas.

- Regions with support from Research shall continue to develop forest type old growth definitions, conduct old growth inventories, develop and implement silvicultural practices to maintain or establish desired old growth values, and explore the concept of ecosystem management on a landscape basis. Where appropriate, land management decisions are to maintain future options so the results from the foregoing efforts can be applied in subsequent decisions. Accordingly, field units are to be innovative in planning and carrying out their activities in managing old growth forests for their many significant values.

Green et al., 1992 states "…old growth is valuable for a whole host of resource reasons such as habitat for certain animal and plants, for aesthetics, for spiritual reasons, for environmental protection, for research purposes, for production of unique resources such as very large trees." And Hamilton, 1993 states, "Values for such items as wildlife, recreation, biological diversity, and juxtaposition of old-growth stands with other forest conditions need to be considered in relation to Forest land management planning objectives."

Marcot et al., 1991 make important points about old growth:

- In current planning and management activities on National Forests, old growth has several values (Sirmon 1985), and one of them is its importance as wildlife habitat (Meehan and others 1984, Meslow and others 1981, Raphael and Barrett 1984, Thomas and others 1988). Old growth provides optimal habitat for some management indicator species, including spotted owl, pileated woodpecker, and marten, and for many other species of plants, fish, amphibians, reptiles, birds, and small mammals (Harris and others 1982, Meslow and others 1981, Raphael 1988c, Raphael and Barrett 1984). It also provides thermal and hiding cover for ungulates, especially in winter (Schoen and others 1984, Wallmo and Schoen 1980). Old growth, therefore, plays an important role in providing for productive populations of some species of special ecological and administrative interest. For some of these species, old growth may be a key factor in providing for continued population viability.

- Additional values of old growth are as natural research areas for scientific study (Greene 1988, Sheppard and Cook 1988) and its ecological role in providing long-term forest productivity (Franklin and others 1981, Perry and others 1988). Other interests in old growth include its recreational, aesthetic, and spiritual significance (Anderson 1988), its contribution to watershed protection (Sedell and Swanson 1984), and its importance as a contributor to biological diversity (Harris 1984, Luman and Neitro 1980, Norse and others 1986).

- Without adequate inventories and without a clear understanding of the amount and distribution of old growth it is difficult for the decision maker to determine what is practical or feasible (Ham 1984:69).

- An old-growth inventory must be designed with a specified degree of reliability. The degree of error and confidence in the statements of amount and distribution should be known, at least qualitatively. The reliability of an inventory is a function of many factors. These include the correctness and usefulness of the classification scheme used; the quality of the sampling design by which remote-sensing images are interpreted and vegetation surveys in the field are conducted; the consistency with which inventory criteria are applied across various land units, taking into account the need to vary criteria by forest type and land form; the availability and quality of remotely sensed images: the expense and training involved in having people interpret the remotely sensed images; the experience and training of field crews; and the sample sizes used in field verification testing and from which subsequent classification strata are derived.

- Some wildlife species may have co-evolved with, and depend on, specific amounts and conditions of old-growth forests. Specific kinds, sizes, and patterns of old-growth environments are, therefore, keys to the long-term survival of these species. Land allocations affect the distribution of old growth across the landscape over time and the effectiveness of old growth as habitat for wildlife. Resulting spatial patterns of old growth influence the viability of many wildlife species that depend on the ecological conditions of old forests. Old growth may provide population "reservoirs" for species that find early successional stages of second-growth conifer stands marginal habitat.

- Landscape attributes affecting the perpetuation of old-growth dependent and associated wildlife include the spatial distribution of old growth; the size of stands; the presence of habitat corridors between old-growth or old-forest stands; proximity to other stands of various successional stages and especially for well-developed mature-forest stages and species with different seasonal uses of habitats; and the susceptibility of the old-growth habitat to catastrophic loss (such as wildfire, insects, disease, wind and ice storms, and volcanic eruptions.

- Stand size, in combination with its landscape context (the condition, activities, or both on the adjacent landscape that affect the stand), is of major significance in perpetuating old-growth resources and can have a major effect on their use by wildlife. Wide-ranging species may be able to use stands of various structural- , size- , and age-classes. If such stands are separated by unsuitable habitat or disruptive activities, however, the remaining old-growth stands become smaller in effective (interior) size, more fragmented, and possibly not suitable for occupancy or for successful reproduction. An old-growth inventory that quantifies such stand and landscape attributes is a prerequisite for evaluating possible context and landscape effects on species' presence.

Rose et al., 2001 is scientific information on dead wood in forest ecosystems. Snags and down dead wood are a defining element of old growth, as Forest Plan Appendix N indicates. In citing dozens of other scientific sources, the authors state many important ecological points supporting the scientific and habitat relevance of those particular items of the six Appendix N criteria. Below, we leave out the internal citations for easier reading:

- Decaying wood has become a major conservation issue in managed forest ecosystems. Of particular interest to wildlife scientists, foresters, and managers are the roles of wood decay in the diversity and distribution of native fauna, and ecosystem processes. Numerous wildlife functions are attributed to decaying wood as a source of food, nutrients, and cover for organisms at numerous trophic levels. Principles of long-term productivity and sustainable forestry include decaying wood as a key feature of productive and resilient ecosystems. (Internal cites omitted.)
- Inputs of decaying wood are crucial to most aspects of stream processes, such as channel morphology, hydrology, and nutrient cycling.
- Wood decay in forests of the Pacific Northwest has recently become a topic of renewed interest at national and global scales, regarding the role of terrestrial carbon storage in the reduction of atmospheric CO2 (a greenhouse gas).
- New research over the past three decades has emphasized the significance of decaying wood to many fish and wildlife species, and to overall ecosystem function. The importance of decaying wood to ecosystem biodiversity, productivity, and sustainability is a keynote topic in two recent regional ecosystem assessments in Oregon and Washington. These, and other publications address both the specific roles of wood decay in ecosystem processes and functions, as well as ecological functions of wildlife species associated with wood decay.
- Interactions among wildlife, other organisms, and decaying wood substrates are essential to ecosystem processes and functions. In the process of meeting their needs, animals accomplish ecosystem work with respect to transformation of energy and cycling of nutrients in wood. For example, chipmunks and squirrels disperse mycorrhizal fungi which play key roles in nutrient cycling for tree growth; birds, bats, and shrews consume insects that decompose wood or feed on invertebrates and microbes; beavers and woodpeckers create habitats by modifying physical structures; arthropods build and aerate soil by decomposing wood material. Relations between wood decay and wildlife have been examined in several recent analyses.
- Managed forests, on average, have lower amounts of large down wood and snags than do natural forests.
- Emphasis on concepts of long-term productivity in this chapter reflects an underlying principle that habitat functions of decaying wood are inextricably linked to ecosystem processes. Careful attention to the whole ecosystem is a prerequisite to successful management of decaying wood for wildlife.

Wood Legacies in Managed Forests

John Hayes

Legacies are structures or components of ecosystems that exist prior to a disturbance and are "inherited" by the post-disturbance community. Legacies can provide important temporal connectivity within a stand, allowing organisms present in a pre-disturbance community to persist in an area following disturbance. In addition, legacy wood can provide structural elements and complexity in a stand that would otherwise require very long periods of time to develop. In managed forests, wood legacies, including large diameter trees, snags, and down wood, are ecologically important structures that play central roles in diverse ecosystem processes and functions, such as geomorphic processes, hydrology, nutrient cycling, and habitat for fish and wildlife. The ecological value of wood legacies has begun to gain widespread recognition only within the past two decades.[122, 164]

As a result of a variety of operational, safety, and economic considerations, application of intensive forest management practices often results in removal of legacy structures from stands and minimal retention of future legacy structures. Growing replacement structures with similar characteristics (e.g., large diameter trees with large diameter branches, thick and deeply-furrowed bark, and complex crown structure) requires decades or longer. Moreover, unless special provisions are made, large diameter trees, snags, and logs with these characteristics may never be produced in forests managed intensively on short- to moderate-length rotations. Habitat quality for species that depend upon or are closely associated with these structures can be seriously diminished with their loss from forest stands. The ecological importance of wood legacies combined with the difficulties of creating replacement structures provide convincing reasons to conserve legacy structures during management activities.

Managing wood legacies through time in managed forests is a multi-staged process. Existing structures that will serve as legacy structures in the post-disturbance environment should be identified prior to a disturbance event, such as logging. In some cases, it may be adequate to rely on the timber sale administrator or loggers to identify appropriate structures and implement the management strategy in the field. Since one intent of legacy structures is to provide various functions through time, it will often be valuable to either individually mark important legacy structures, or to document their location and purpose so that future managers can take the structures into account. Of equal importance, plans for recruitment of future legacy structures should be prepared to ensure that legacy structures will be available in future stands. Innovative silvicultural practices can be employed to create conditions favorable to development of future legacy structures.

- Of the biological agents of wood decay, insects and fungi are the principal players in coniferous forest ecosystems.
- Down wood, snags, and live trees with decay serve vital roles in meeting the life history needs of wildlife species in Oregon and Washington.
- Woodpeckers, sapsuckers, and nuthatches are highly specific in their selection of tree species for nesting and roosting, and this selectivity is attributed to the presence of decay fungi.
- To be useful to most cavity excavators, live trees usually must contain wood in a Class 2 stage of decomposition. For example, strong excavators, such as Williamson's sapsuckers, pileated woodpeckers, and black-backed woodpeckers, select trees with a sound exterior sapwood shell and decaying heartwood to excavate their nest cavities.
- Hollow trees larger than 20 inches (51 cm) in diameter at breast height (dbh) are the most valuable for denning, shelter, roosting, and hunting by a wide range of animals. Hollow chambers are used as dens by black bears, as night roosts by woodpeckers, and as dens, shelter, roosts, and hunting sites by a variety of animals, including flying squirrels, wood rats, bats, American marten, northern flickers and Vaux's swift.
- Hollow trees and down wood are formed from only a few tree species that can maintain bole structural integrity as the heartwood decays. Western redcedar is especially valuable in providing hollow trees because the decay-resistant sapwood remains structurally sound

for centuries. In the Interior Columbia Basin, grand fir and western larch form the best hollow trees for wildlife uses.

- Broomed trees caused by mistletoe, rust, or needlecast fungi may remain alive for decades, and have attributes distinct from decay patches in live trees. Abundant forage is produced from mistletoe shoots and fruits. Regardless of the extent of decay, broom infections provide various habitat functions to wildlife depending on how and where they form along the bole. For example, mistletoe brooms form platforms used for nesting, roosting, and resting sites by owls, hawks, and song birds; roosting by grouse; and resting cover by squirrels, porcupines, and marten.
- The abundance of cavity-using species is directly related to the presence or absence of suitable cavity trees. Habitat suitability for cavity-users is influenced by the size (diameter and height), abundance, density, distribution, species, and decay characteristics of snags. In addition, the structural condition of surrounding vegetation determines foraging opportunities.
- Stumps provide a variety of wildlife habitats. Stumps with sloughing bark (Class 2) provide sites for bat roosts, and foraging sites for flickers, and downy, hairy and pileated woodpeckers. In openings, tall stumps with advanced decay (Class 3) provide nest sites for flickers, and subsequently for blue birds and other secondary cavity-nesters associated with openings. Squirrels and chipmunks also use stumps as lookouts and platforms for cone-shredding.
- Down Woody Material (logs). Down wood affords a diversity of habitat functions for wildlife, including foraging sites, hiding and thermal cover, denning, nesting, travel corridors, and vantage points for predator avoidance. Larger down wood (diameter and length) generally has more potential uses as wildlife habitat. Large diameter logs, especially hollow ones are used by vertebrates for hiding and denning structures. Bears forage for invertebrates in logs during summer and fall. Fishers use large logs to a limited degree as den sites.
- Lynx select dense patches of downed trees for denning. Jackstrawed piles of logs form a habitat matrix offering thermal cover, hiding cover, and hunting areas for species such as marten, mink, cougar, lynx, fishers, and small mammals (Figure 8). Smaller logs benefit amphibians, reptiles, and mammals that use wood as escape cover and shelter. Small mammals use logs extensively as runways (Figure 9). California red-backed voles use Class 2-3 down logs for cover, and feed on fungi (especially truffles) and lichens growing in close association with down wood.
- The moist environment beneath loose bark, bark piles and in termite channels of logs with advanced decay provides a protected area for foraging by salamanders. The cool, moist environment of rotten wood may be required for some species of salamanders to survive heat stress during summer. Decaying wood also provides habitat for invertebrates on which salamanders and other foraging vertebrates feed (e.g., collembolans, isopods, millipedes, mites, earthworms, ants, beetles, flies, spiders and snails). The folding-door spider constructs a silk tube within the cracks and crevices of wood with advanced decay.
- Habitat structures in upper layers of the forest floor (soil, litter, duff) result from processes involving organic material (litter, decaying roots, vertebrate and invertebrate carrion, and fecal matter) and a diverse community of organisms, including bacteria, fungi, algae, protozoa, nematodes, arthropods, earthworms, amphibians, reptiles, and small mammals. The complex trophic web supported by nutrient and moisture conditions

within the litter and duff layers transforms plant material into a variety of degradation products, thereby storing and releasing nutrients within the ecosystem.

- Decaying wood forms many habitat structures in riparian forests. Accumulations of large wood on stream banks provide habitat for small mammals and birds that feed on stream biota, and provide structural diversity in streamside forests.
- The role of down wood in salmon habitat has received much attention over the past two decades. Large wood is a key component of salmonid habitat both as a structural element and as cover and refugia from high flows. Large wood serves key functions in channel morphology, as well as sediment and water routing. The importance of wood to salmon habitat varies from headwater to stream mouth. As stream order increases and gradient decreases in third- to fifth-order streams, down wood is a dominant channel-forming feature. Larger wood deflects water and increases hydraulic diversity, producing a range of pool conditions that serve as habitats for juvenile salmonids in summer. Diverse channel margins are a primary aspect of rearing habitat. Flow obstructions created by large wood provide foraging areas for young salmonid fry that are not yet able to swim in fast currents, and provide refugia to juvenile salmonids at high flow. In higher order streams, flow deflections created by large wood trap sediments and nutrients, and enhance the quality of gravels for spawning. Down wood is less of a channel-forming feature along large rivers, but defines meander cutoffs and provides cover and increased invertebrate productivity for juvenile salmonids.
- Processes that sustain the long-term productivity of ecosystems have become the centerpiece of new directives in ecosystem management and sustainable forestry. Given the key role of decaying wood in long-term productivity of forest ecosystems in the Pacific Northwest, the topic should remain of keen interest to scientists and managers during the coming decade. Below, we highlight functions of decaying wood directly linked to long-term productivity, including influences on the frequency and severity of disturbances such as fire, disease, and insect outbreaks.
- Nutrient Cycling and Soil Fertility. Decaying wood has been likened to a savings account for nutrients and organic matter, and has also been described as a short-term sink, but a long-term source of nutrients in forest ecosystems.
- Nutrient cycling via foliage and fine litter has been well-described. Substantial amounts of nitrogen are returned to the soil from coarse wood inputs, yet even where annual rates of wood input are high, 4 to 15 times more nitrogen is returned to the forest floor from foliage than from large wood. This is a consequence of the higher nutrient concentrations and shorter turnover times of leaf litter compared to wood. The relative contribution of large wood to the total nutrient pool in an ecosystem depends to a large extent, on the size of other organic pools in the system.
- The slow rate of nutrient release from decomposing wood may serve to synchronize nutrient release with nutritional demands in forests, and also to minimize nutrient losses via leaching to the ground water. In addition to nitrogen bound chemically within wood, down wood reduces nutrient losses from ecosystems by intercepting nutrients in litterfall and throughfall. Favorable temperature and moisture conditions also makes large decaying wood sites of significant nitrogen inputs via N-fixation.
- Soil is the foundation of the forest ecosystem. Large wood is a major source of humus and soil organic matter that improves soil development.

- Moisture Retention. Water stored in large decomposing wood accelerates microbial decay rates by stabilizing temperature and preventing desiccation during the summer.11, 160, 376 Moist conditions within the wood favor decay by attracting burrowing and tunneling mammals and invertebrates that improve aeration of wood, and by providing colonization substrate and moisture for mycorrhizae and other fungi. Moist .nurse logs. also provide excellent sites for seedling establishment and production of sporocarps. These processes increase retention and cycling of nutrients within ecosystems and contribute to higher biodiversity and biomass production.
- Mycorrhizae. Mycorrhiza, meaning fungus-root, is a symbiotic association of fungi with plant roots. The fungus improves nutrient and water availability to the host in exchange for energy derived from plant sugars. Mycorrhizae are necessary for the survival of numerous tree families, including pine, hemlock, spruce, true fir, Douglas-fir, larch, oak, and alder. Mycorrhizal associations are a source of nutrients to promote wood decay. By the time a log reaches more advanced stages of decomposition (Class 3) fungal colonization leads to the accumulation of nutrients in hyphae, rhizomorphs and sporocarps, especially for ectomycorrhizal fungi, where >90% of the fungal activity is associated with organic material. Ectomycorrhizal fungi decrease the ratio of carbon to nitrogen in decomposing wood, and mediate nutrient availability to plants while improving nutrient retention by forest ecosystems.
- The energy derived from falling or flowing water is the driving force behind erosion processes in Pacific Northwest forests. By covering soil surfaces and dissipating energy in flowing and splashing water, logs and other forms of coarse wood significantly reduce erosion. Large trees lying along contours reduce erosion by forming a barrier to creeping and raveling soils, especially on steep terrain. Material deposited on the upslope side of fallen logs absorbs moisture and creates favorable substrates for plants that stabilize soil and reduce runoff.
- Stand Regeneration and Ecosystem Succession. Decomposing wood serves as a superior seed bed for some plants because of accumulated nutrients and water, accelerated soil development, reduced erosion, and lower competition from mosses and herbs. In the Pacific Northwest, decaying wood influences forest succession by serving as nursery sites for shade-tolerant species such as western hemlock, the climax species in moist Douglas-fir habitat. Wood that covers the forest floor also modifies plant establishment by inhibiting plant growth, and by altering physical, microclimatic, and biological properties of the underlying soil. For example, elevated levels of nitrogen fixation in Ceanothus velutinus and red alder have been reported under old logs.
- Streams and Riparian Forests. Long-term productivity in streams and riparian areas is closely linked to nutrient inputs, to attributes of channel morphology, and to flow dynamics created by decaying wood. Small wood contributes to nutrient dynamics within streams and provides substrates to support biological activity by microorganisms, as well as invertebrates and other aquatic organisms. Much of the organic matter processed by the aquatic community originates in riparian forests and is stored as logs.
- Large wood is the principal factor determining the productivity of aquatic habitats in low- and mid-order forested streams. Large wood stabilizes small streams by dissipating energy, protecting streambanks, regulating the distribution and temporal stability of fast-water erosional areas and slow-water depositional sites, shaping channel morphology by routing sediment and water, and by providing substrate for biological activity. The

influence of large wood on energy dissipation in streams influences virtually all aspects of ecological processes in aquatic environments, and is responsible for much of the habitat diversity in stream and riparian ecosystems. The stair-step gradients produced by wood in small stream basins supports higher productivity and greater habitat diversity than that found in even-gradient streams lacking wood structure.

- The input rates and average piece size of dead wood generally increase with stand age, although the amount of decaying wood can follow a U-shaped pattern if young forests inherit large amounts of decaying wood and live trees from preceding stands.346
- Insects and pathogens play a key role in maintaining diverse and productive forests by creating habitat and stimulating nutrient cycling
- Intensive forest management activities that have decreased the density of large snags in early forest successional stages (sapling/pole and small tree stages) may have had adverse impacts on the 61 associated wildlife species (Figure 12). Similarly, the lesser amount of large down wood in early forest successional stages may not provide as well for the 24 associated wildlife species. Such results suggest the continuing need for specific management guidelines to provide large standing and down dead wood in all successional stages.
- These silvicultural practices clearly altered the abundance and recruitment of large down wood and snags in managed forests of the Pacific Northwest, including:
    1. Lower abundance of large diameter snags and down wood legacies in managed forests (and streams); e.g. lack of the U-shaped pattern; higher accumulation of smaller-diameter fuels in eastside forests.
    2. Reduced recruitment and retention of large trees to provide future legacies.
    3. Shorter mean residence time for down wood (i.e. faster decomposition as a function of reduced log diameter).
    4. Altered species composition of forests (westside: more Douglas-fir, less western red cedar; eastside: less pine, more true fir species).
- Several major lessons have been learned in the period 1979-1999 that have tested critical assumptions of these earlier management advisory models:
    - Calculations of numbers of snags required by woodpeckers based on assessing their biological potential. (that is, summing numbers of snags used per pair, accounting for unused snags, and extrapolating snag numbers based on population density) is a flawed technique. Empirical studies are suggesting that snag numbers in areas used and selected by some wildlife species are far higher than those calculated by this technique.
    - Setting a goal of 40% of habitat capability for primary excavators, mainly woodpeckers, is likely to be insufficient for maintaining viable populations.
    - Numbers and sizes (dbh) of snags used and selected by secondary cavity-nesters often exceed those of primary cavity excavators.
    - Clumping of snags and down wood may be a natural pattern, and clumps may be selected by some species, so that providing only even distributions may be insufficient to meet all species needs.
    - Other forms of decaying wood, including hollow trees, natural tree cavities, peeling bark, and dead parts of live trees, as well as fungi and mistletoe associated with wood decay, all provide resources for wildlife, and should be considered along with snags and down wood in management guidelines.

    - The ecological roles played by wildlife associated with decaying wood extend well beyond those structures per se, and can be significant factors influencing community diversity and ecosystem processes.
- Furthermore, although the analysis of inventory data presents data on dead wood abundance, management actions at the local level may best be focused on the ecological processes that lead to development of these forest structures rather than on the abundance of structures themselves. Management decisions also may require information on the spatial distribution (landscape pattern) of dead wood, which cannot be estimated from sample-based inventories.
- If detailed data on the current and historical range of natural conditions is lacking (which is likely), it may be preferable to substitute functional target values for specific wildlife species. For example, to provide maximum habitat elements for specific cavity-nesting species, a designated quantity and distribution of snags
- Effective management of decaying wood must do more than simply provide for inputs of dead trees. Rather, management should strive to provide for diversity of tree species and size classes, in various stages of decay and in different locations and orientations within the stand and landscape.
- Green trees function as a refugium of biodiversity in forests. For example, many species of invertebrate fauna in soil, stem, and canopy habitats of old-growth forests do not disperse well, and thus, do not readily recolonize clear-cut areas. The same concept holds for many mycorrhizae-forming fungal species. Added benefits of green tree retention include moderated microclimates of the cutover area, which may increase seedling survival, reduce additional losses of biodiversity on stressed sites, and facilitate movement of organisms through cutover patches of the landscape.
- In situations where forest management objectives extend beyond wood production to broader biological and human values, intensive forestry practices by themselves may inadequately maintain or restore biodiversity, especially in early and late successional forest development phases. Species, processes, and values associated with older stages of stand development (transition and shifting gap stages) are likely impaired or absent from intensively managed stands. Species and processes associated with the early establishment phase also have shorter duration than may occur naturally. This does not mean that intensive forest management practices are incompatible with multiple forest objectives at a landscape scale, but rather that species and processes associated with early and late stages of forest development should be assessed over large areas such as landscapes, subregions, and regions.
- Management for certain species must consider habitat requirements at different spatial and temporal scales. It may then be possible to modify silvicultural practices at the stand scale to meet multiple objectives at landscape and larger scales. The landscape perspective also is pertinent to managing riparian systems, where the role of wood decay in riparian environments varies according to the type and geography of the associated water body.
- The decline of species associated with late-successional forest structures, as well as the prolonged time needed to produce wood legacies, suggests that it is both ecologically and economically advantageous to retain legacy structures across harvest cycles wherever possible, rather than attempt to restore structures that have been depleted. This is especially obvious for slow-growing tree species and very large wood structures.

> Retention of old- growth structural legacies has been identified as critical to conservation of biodiversity between large reserves and conservation areas.

Please see our comments on the Draft Forest Plan and its Draft EIS, for further discussion of old-growth issues and best available science.

Franklin and Spies, 1991 also make several relevant points about old growth:

- Old-growth forest is a biological or ecological concept that presumes ecosystems systematically change as they persist over long periods. An ecosystem has, in effect, a series of linked life stages …which vary in composition, function, and structure. Such progressions can take a very long time in forests because the dominant organisms, trees, typically live very long.

- Characterizing old-growth forests is possible based on these concepts. Obviously, a series of ecological attributes must be considered because of the many relevant compositional, functional, and structural features. For practical reasons, however, a working definition—one for everyday use in gathering stand data—emphasizes structural and compositional rather than the conceptually important functional features that are difficult to measure.

- Old-growth forests are later stages in forest development that are often compositionally and always structurally distinct from earlier successional stages.

- The age at which forests become old growth varies widely with forest type or species, site conditions, and stand history.

- Structurally, old-growth stands are characterized by a wide within-stand range of tree sizes and spacing and include trees that are large for the particular species and site combination. Decadence is often evident in larger and older trees. Multiple canopy layers are generally present. Total organic matter accumulations are high relative to other developmental stages. Functionally, old-growth forests are characterized by slow growth of the dominant trees and stable biomass accumulations that are constant over long periods.

- Our failure to study old-growth forests as ecosystems is increasingly serious in considerations of old-growth issues. Without adequate basic knowledge of the ecosystem, we risk losing track of its totality in our preoccupation with individual attributes or species. Definitional approaches to old growth based on attributes, including those that we have presented here, predispose us to such myopia. The values and services represented by old-growth ecosystems will be placed at ever greater risk if we perpetuate our current ignorance about these ecosystems. It will also increase doubts about our ability to manage for either old-growth ecosystems or individual attributes (for example, species and structures) associated with old growth. We must increase ecosystem understanding and management emphasis on holistic perspectives as we plan for replacement of old-growth forests. How can we presume to maintain or re-create what we do not understand? Some may presume that ignorance (on ecological values of old

> growth) is bliss, but this attitude creates high risk that we will continue to be blindsided by subsequent discoveries.

Yanishevsky (1994) points out the inadequacy of maintaining merely "minimum" amounts of habitat such as snags and old growth. One might assume the NPNF Forest Plan minimum old-growth standards are based upon historic amounts prior to EuroAmerican exploitation, so that maintaining such minimum would safeguard wildlife populations so they wouldn't vanish from any national forest or need listing under the ESA. But estimates of the amount of old growth on the Forest prior to EuroAmerican management are not available or reliable, because so much forest had been logged long before adoption of old-growth definitions. This is expressed in FS statements responding to requests for data on presettlement amounts of old growth. For example, USDA Forest Service, 2019c states:

> Regarding the historic range of variability of old growth in the analysis area, **there is no way to accurately determine how much of the Forest may have met the Green definitions of old growth (Green et al., 1992)**. To determine whether a forest stand meets those definitions, it requires detailed information on how many trees per acre exist in the stand over a certain diameter and age, the total stand density, the forest type and lastly, the habitat type group that the stand occupies. **No historical information exists that can provide that level of detail.** Therefore, a numeric desired condition or an HRV estimate for old growth is not included in this analysis. (Emphases added.)

Similarly, the Northern Region's Bollenbacher and Hahn, 2008g state, "actual estimates for the amount of OG are constrained by the limited field inventory data collected before the 1930s, and inconsistent—or absent—OG definitions."

The 1987 Forest Plan must be amended to require that minimum old-growth standards are consistent with the best available science.

<u>Remedy Requested:</u> Select the No Action Alternative, or:

- Eliminate all logging in areas that the FS has found to qualify as, or might qualify as FPOG or NIOG; or prepare a revised or supplemental EIS after gathering and analyzing additional information to properly determine whether stands qualify as FPOG, and then take public comment and consider new alternatives before deciding how to proceed.
- Eliminate all logging in areas FS has found to qualify as replacement old growth; or hold off on issuing a decision until the FS is able to properly designate replacement old growth as required under Appendix N.
- Hold off on issuing a decision until the FS is able to properly evaluate the amount of FPOG and replacement old growth that will no longer qualify as such though another supplemental EIS process.
- Amend the Forest Plan to reflect updated information on old growth, its historic extent and distribution on the forest, and best available science.
- Respond affirmatively and timely to our request to meet with the appropriate NPCNF experts for a transparent discussion about the agency's old-growth inventory and methodology.

GRIZZLY BEAR

This is an ecological and management issue that is constantly changing, as the FS itself sees by changing its analysis once the original Objection period concluded and because of the evolution of management in the Bitterroot Ecosystem/recovery zone (BE).

Grizzly bears once ranged throughout most of western North America, from the high Arctic to the Sierra Madre Occidental of Mexico, and from the coast of California across most of the Great Plains. Prior to European settlement, scientists believed that approximately 50,000 grizzly bears occupied the western United States between Canada and Mexico. With European settlement of the American West and a federally funded bounty program aimed at eradication, grizzly bears were shot, trapped, and poisoned, reducing the population to just 2 percent of their historic range. As a result of its precipitous decline, The USFWS listed the grizzly bear as a "Threatened" species in the lower 48 states under the Endangered Species Act in 1975. Today scientists estimate there are approximately 2,000 grizzly bears left in the lower 48 states, occupying five isolated populations.

One of the main factors hindering grizzly bear recovery is the lack of connectivity between recovery zones due to degraded habitat conditions caused by a variety of factors, but especially roads. Roads can increase risk of mortality, change bear behavior, resulting in habitat loss, habitat alteration, habitat displacement, habitat fragmentation, and population fragmentation. (Proctor, et al. 2019; MacHutchon & Proctor 2015.) Roads change wildlife habitat in more extreme and permanent ways than other anthropogenic causes of fragmentation. (Forman & Alexander 1998; Spellerberg 1998.) Roads not only cause striking changes to physical landscapes but also alter the ecosystem's general function and the patterns of wildlife use within these landscapes. (Reed et al. 1996; Transportation Research Board 1997; Shirvani et al. 2020.) Traffic on roads can create barriers or filters to animal movement and in some cases the leading cause of animal mortality. (Chruszcz et al. 2003; Clevenger & Wierzchowski 2006; Northrup et al. 2012.) Increased human use on new roads, including legal use during project implementation and illegal public use after project implementation, creates the potential for increased mortality and poaching of grizzly bears—impacts the FEIS fails to analyze. For these reasons, roads and human activity can negatively impact grizzly bear recovery. (Lamb et al. 2018.) Therefore, Proctor, et al. 2019 conclude:

> Motorized access management would be most beneficial in threatened populations, in areas where roads occur in the highest quality habitats, within and adjacent to identified linkage areas between population units, and in areas that are expected to exceed motorized route thresholds as a result of resource extraction activities.

Hungry Ridge timber sale activities would further reduce grizzly bear connectivity and hinder population recovery in the BE. The FS fails to analyze how the proposed actions would affect grizzly bear habitat security and areas of demographic connectivity, such as discussed in Sieracki & Bader, 2022. Such an analysis requires discrete geographic parameters in which to measure habitat security, and motorized route densities. Yet, specific bear management units have yet to be identified in the NPCNF by any federal or state wildlife agency. Hence the Sieracki & Bader report, which identifies and displays Bear Management Units (BMUs) throughout the Bitterroot

National Forest and Lolo National Forest and parts of the Beaverhead-Deerlodge National Forest. Proposed BMUs for the BE (Mattson 2021) and the secure habitat identified in Sieracki & Bader, 2022 provide a foundation for a more robust grizzly bear analysis both within the project area and considering cumulative effects on demographic connectivity.

The USFWS's 2022 Species Status Assessment for the Grizzly Bear (Ursus arctos horribilis) in the Lower-48 States finds that the grizzly bear population in the lower 48 states is likely to become in danger of extinction within the foreseeable future throughout all of its range, and that "viability for the grizzly bear in the lower-48 States as a whole only increases under …future scenarios, which rely on increases in conservation efforts such that the [Bitterroot Ecosystem] and North Cascades support resilient populations." In other words, true recovery of the Threatened grizzly population cannot happen without recovery of a robust population in the Bitterroot Ecosystem.

The proposed road construction and reconstruction would significantly impact grizzly bear habitat security and connectivity. The proposed permanent road construction would surely decrease grizzly bear habitat security and connectivity. Furthermore, since the FEIS fails to disclose the current level or degree of accessibility on all the routes for which it proposes "maintenance" it fails to portray an accurate estimation of the adverse impacts of the project on grizzly bears, other species of conservation concern affected by roads, and indeed many indicators of ecological integrity.

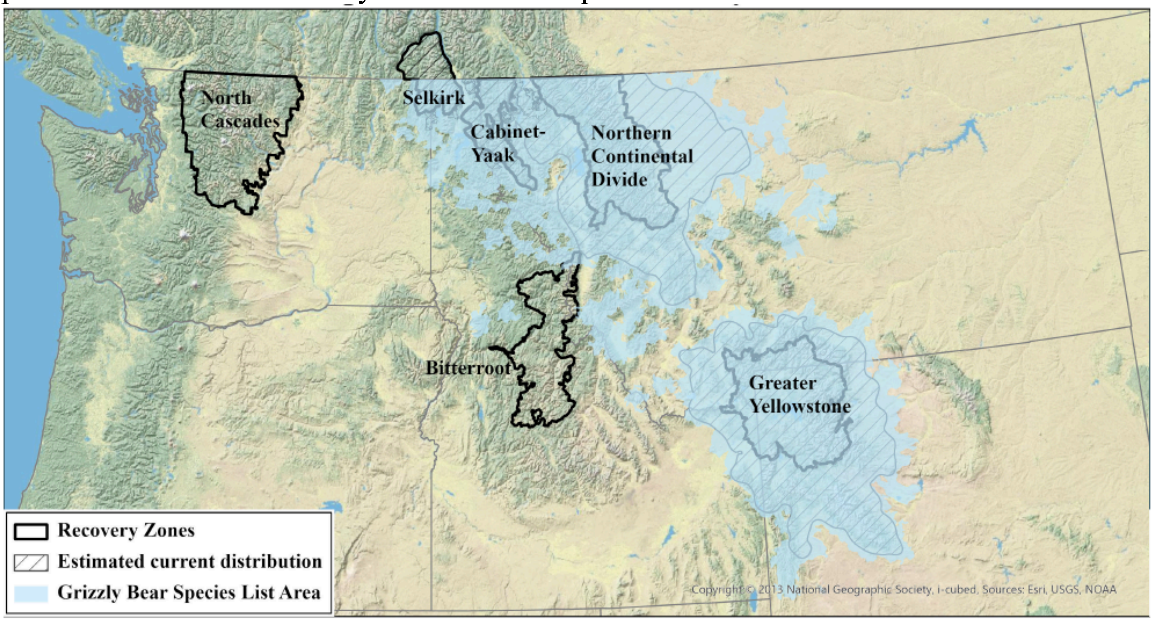
The proposed road reconstruction would adversely impact grizzly bears. Road reconstruction involves blading, brushing, and other improvements. Reconstruction of impassible roads reintroduces motor vehicle traffic to locations where it had subsided or diminished. Reconstruction of passible roads can increase traffic volumes on roads that were already under some level of motor vehicle use because reconstruction inevitably improves the surface of the road, inviting more public travel.

Although temporary roads are intended to be decommissioned within three years of the completion of logging operations, grizzly bear habitat security and connectivity are decreased when temporary roads and constructed and used. Habitat security and connectivity is not restored until temporary roads are successfully decommissioned. And the science shows that it takes years for resident grizzly bears to realize such benefits. In other recovery areas and connectivity areas where there are limitations on motorized access to promote grizzly bear recovery, the amount of temporary roads that the FS can construct and use at any given time must be within stated limits on motorized access.

Merrill, et al., 1999 identify seasonal productive grizzly bear habitats in Idaho including the project area. The authors state that grizzly bears have good chances of surviving and reproducing in the BE "if bears in central Idaho are accorded protection from direct mortality comparable to that provided bears in other recovery areas."

Hertel et al. (2019) discovered that explorer bears are important to connectivity and persistence of the species: "Bolder individuals seem to be more tolerant towards human encroachment and move more easily through human-modified landscapes…" which has implications for dispersal and population connectivity. Grizzly bears that are roaming into areas not densely occupied, or thought to be otherwise unoccupied, are highly important and should be recognized as resident. Yet the FS has been treating grizzlies that show up on the NPCNF in recent years as "transients" instead of the natural agents of population recovery they really are.

In July 2022 the USFWS updated the species list area map of where grizzly bears "may be present." Below is that "May Be Present" map:



The map shows areas in light blue of known recent documentation of grizzly bears. We believe the USFWS only grudgingly included those isolated areas to the west of the BE because those recent occurrences are well-documented. The agencies apparently refuse to acknowledge the likelihood of grizzly occurrence in areas beyond those two small blue splotches, which is biologically realistic given the well-known ability of grizzly bears to cover great distances, and the possibility of grizzly bears—known to avoid areas of human activity—existing there but remaining undetected.

Similarly the Forest's Twentymile Proposed Action from earlier this year expressed the NPCNF's current position on grizzly bears: "The Bitterroot Ecosystem in currently unoccupied, per USFWS's Bitterroot Environmental Impact Statement (USFWS, 2000, pp. 3-14–15)." We reject the relevancy of the FS's considering the BE to be "unoccupied" by this native wildlife species. To the degree it's true, it is because of the ongoing mismanagement of grizzly bear habitat in the BE by the FS. Furthermore that EIS is 23 years old, and on March 15, 2023 in AWR v. Cooley a U.S. District court in Montana ordered the USFWS to re-analyze the recovery of grizzly bears in the BE. The Court recognized non-discretionary legally binding commitments made in the 2000 Record of Decision and Final Rule, plus the USFWS's failure to manage accordingly. The Judge recognized that "as recently as October 2022, grizzly bears have been seen in the Bitterroot Ecosystem." The Judge's order requires the USFWS to supplement its 2000 Final EIS and come up with a new decision.

In updating the consultation on forest plan impacts on grizzly bears, the FS should be identifying key habitat components for grizzly bears for prioritizing road density reductions (Proctor, et al., 2020) so populations can recover.

Schwartz et al. (2010) noted that management for grizzly bears requires provisions for security areas and limits of road densities between security areas. Otherwise, grizzly bear mortality risks will be high as bears attempt to move across highly roaded landscapes to other security areas. The Forest Plan lacks direction regarding road densities located outside of and between security areas.

Mattson (2021) is a report investigating grizzly bear recovery in the BE and NPCNF. At pp. 56 - 59 (7.c. Habitat Security on the Nez Perce-Clearwater National Forests) Mattson discusses road densities and core security in proposed BMUs for the NPCNF. The FS continues to ignore this recommended management scheme, which would help facilitate grizzly bear recovery in the BE.

As Mattson (2021) explains, grizzly bear habitat quality in the BE is potentially outstanding, but strong steps are needed immediately to remove the human impediments to natural recovery. Recovery of the overall grizzly bear population in the lower 48 states requires its population to grow and its range expand, especially in anticipation of the impending risk of climate change.

The FS is aware of the best programmatic agency direction it has adopted to date, that established in Flathead Forest Plan Amendment 19. It established Open Motorized Route Density (OMRD)/Total Motorized Route Density (TMRD)/Security Core indices. These are based upon the scientific information concerning security from roads and road density requirements for grizzly bears as found in Mace and Manley, 1993 and Mace et al., 1996.

Sells et al. (2023) sought to "identify important movement routes and habitat linkage areas between grizzly bear ecosystems " i.e., "to identify potential dispersal pathways among ecosystems." Results of their modeling yielded linking zones as identified in maps. For example, their Figure 3 for predicted female grizzly dispersal from the NCDE into the BE is displayed next:

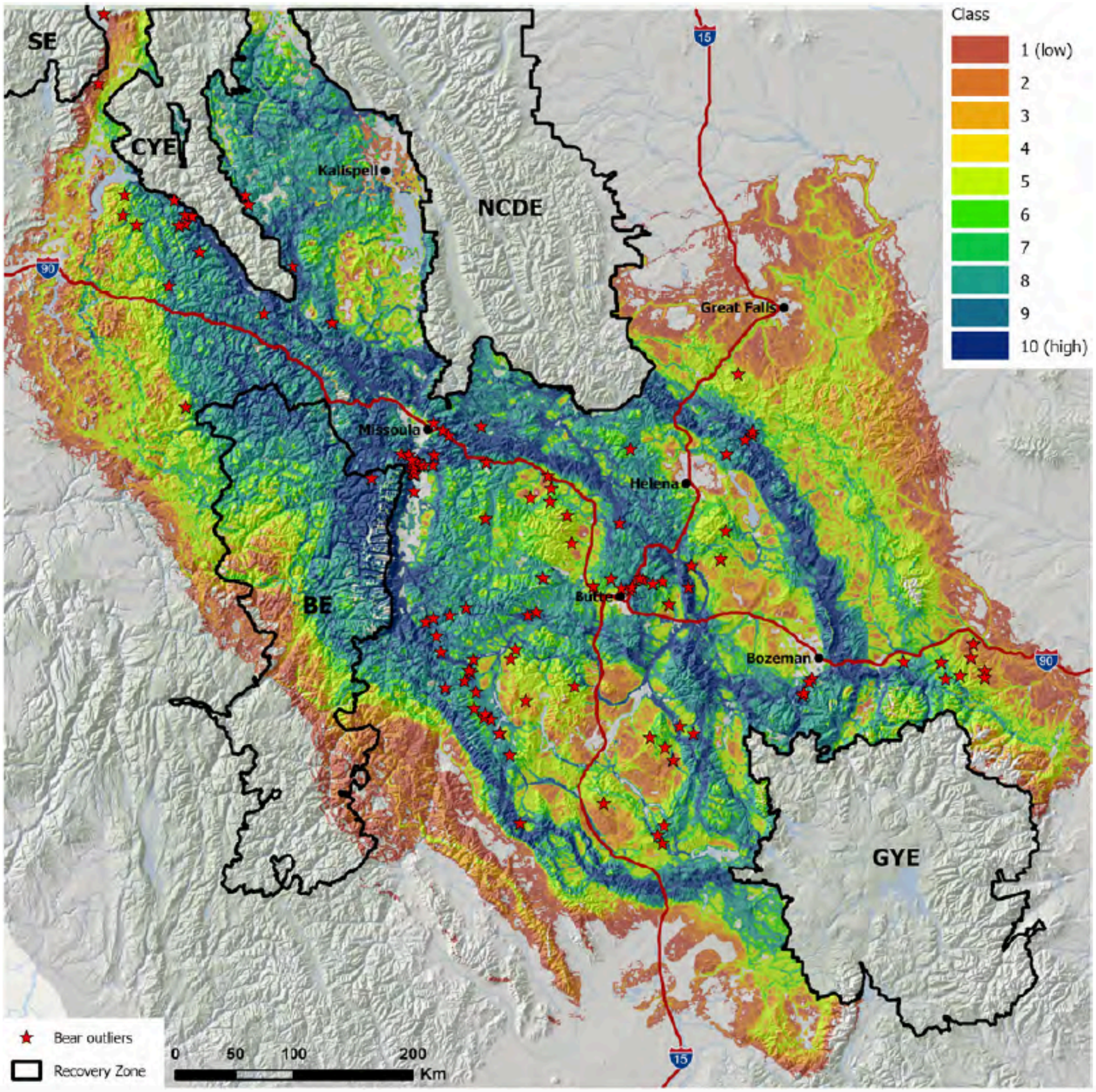


Fig. 3. Prediction of female grizzly bear connectivity pathways in western Montana, summarized from 5 sets of directed (randomized shortest path) movement simulations using start and end nodes associated with routes of NCDE-CYE, NCDE-BE, NCDE-GYE, CYE-BE, and GYE-BE (Fig. 1). Class 1 = lowest relative predicted use, whereas class 10 = highest relative predicted use. Simulations were based on 46 individual iSSFs for NCDE females. These simulations employed the lowest θ value of 0.0001, which resulted in the highest correlation with independent grizzly bear outlier observations (Table 1). Results from other θ values shown in the Appendix.

The FS has no Forest Plan direction recognizing the importance of fostering and protecting such connectivity habitat, and does not consider it in the FEIS.

Remedy Requested:

Select the No Action Alternative. Amend the Forest Plan to adopt habitat management standards as per Mattson (2021) and similar FS plan direction.

CLIMATE CHANGE AND CARBON SEQUESTRATION

FSEIS Appendix F states: "The project climate change and carbon sequestration analysis tiers to the detailed analysis ongoing for Forest Plan revision and the science supporting it." The FS cannot properly tier any analysis of the Hungry Ridge project to the as yet incomplete forest plan revision. For one reason, the FS has still not publicized written responses to any comments on the draft revised forest plan or its accompanying draft EIS. How can the public be properly informed if the ball is in the FS's court, and it fails to act?

The FSEIS states, **"**Potential negative effects may be mitigated and completely reversed with time as the forests regrow." In a recent court decision (Center for Biological Diversity et al v. U.S. Forest Service; CV 22-114-M-DWM) regarding the Black Ram timber sale on the Kootenai National Forest, which would log old growth, Judge Molloy disagrees with that position:

> Ultimately, "[greenhouse gas] reduction must happen quickly" and removing carbon from forests in the form of logging, even if the trees are going to grow back, will take decades to centuries to re-sequester. FS-038329. Put more simply, logging causes immediate carbon losses, while re-sequestration happens slowly over time, **time that the planet may not have**. FS-020739 (I[t] is recognized that global climate research indicates the world's climate is warming and that most of the observed 20th century increase in global average temperatures is very likely due to increased human-caused greenhouse gas emissions.").
>
> …NEPA requires more than a statement of platitudes, it requires appraisal to the public of the actual impacts of an individual project. …(T)he USFS has the responsibility to give the public an accurate picture of what impacts a project may have, no matter how "infinitesimal" they believe they may be.

We incorporate Friends of the Clearwater et al.'s May 30, 2023 letter to the NPCNF forest plan revision team within this objection. That letter cites Talberth (2023), a discussion on how the draft EIS and draft Revised Forest Plan fail to account for: (a) life cycle greenhouse gas emissions (emissions from logging, road building and livestock grazing) and how they're elevated over the long term as compare to natural, unlogged and ungrazed forests); (b) changes in carbon sequestration capacity (logging turns forest from net carbon accumulators into carbon emitters for at least 15 years after logging); and (c) changes in climate resiliency—which means how more much less logged forests are capable of withstanding the ongoing impacts of climate change as compared to natural mature and old forests. Key findings in the Talberth (2023) report are:

- The policy and regulatory framework governing revision of national forest land and resource management plans requires careful consideration of how proposed management activities will amplify or mitigate the effects of climate change.
- The draft revised land and resource management plan (LRMP) and environmental impact statement (DEIS) for the Nez Perce – Clearwater National Forest fails to disclose or mitigate the climate impacts associated with logging, road building, grazing and other land-disturbing activities even though the methods and sources of information to do so are readily available.

- To demonstrate, this report provides preliminary estimates of GHG emissions associated with logging, road building, and grazing activities and reviews the many ways these management activities could make the land more vulnerable to climate change.
- Across the five alternatives considered in the DEIS, GHG emissions from these activities are likely to range between 335,000 and 1,200,000 metric tons carbon dioxide equivalent per year. At the high end of this range, this is equivalent to putting 250,000 new passenger vehicles on the road.
- Logging, road construction and grazing activities are also likely to amplify the effects of climate change by making the land more susceptible to heat waves, droughts, water shortages, wildfires, wind damage, landslides, floods, warming waters, harmful algae blooms, insects, disease, exotic species, and biodiversity loss.

Also see Eve, et al., 2014 regarding existing quantitative tools for such analyses. There is nothing in the FEIS or supporting documents to indicate the FS is accounting for greenhouse gases in any legitimate quantitative manner.

To comply with recent National Environmental Policy Act guidance and other climate policy directives, the NPNF Forest Plan must be amended to incorporate this information and minimize climate impacts.

In a literature review from leading experts on forest carbon storage, Law, et al. (2020) reported:

> There is absolutely no evidence that thinning forests increases biomass stored (Zhou et al. 2013). It takes decades to centuries for carbon to accumulate in forest vegetation and soils (Sun et al. 2004, Hudiburg et al. 2009, Schlesinger 2018), and it takes decades to centuries for dead wood to decompose. We must preserve medium to high biomass (carbon-dense) forest not only because of their carbon potential but also because they have the greatest biodiversity of forest species (Krankina et al. 2014, Buotte et al. 2019, 2020).

Law and Moomaw, 2021 recently concluded:

> Recent projections show that to prevent the worst impacts of climate change, governments will have to increase their pledges to reduce carbon emissions by as much as 80%. We see the next 10 to 20 years as a critical window for climate action, and believe that **permanent protection for mature and old forests is the greatest opportunity for near-term climate benefits.** (Emphasis added.)

Also *see* Dr. Law explaining these matters in the video, "The Surprising Truth Behind Planting Trees and Climate Change."

McKinley et al. (2011) state:

- …most of the aboveground carbon stocks are retained after fire in dead tree biomass, because fire typically only consumes the leaves and small twigs, the litter layer or duff, and some dead trees and logs.

- Generally, harvesting forests with high biomass and planting a new forest will reduce overall carbon stocks more than if the forest were retained, even counting the carbon storage in harvested wood products (Harmon et al. 1996, Harmon et al. 2009). Thinning increases the size and vigor of individual trees, but generally reduces net carbon storage rates and carbon storage at the stand level (Schonau and Coetzee 1989, Dore et al. 2010).

- Methane release from anaerobic decomposition of wood and paper in landfills reduces the benefit of storing carbon because methane has about 25 times more global warming potential than CO2. For some paper, the global warming potential of methane release exceeds its carbon storage potential,

- There are two views regarding the science on carbon savings through fuel treatments. Some studies have shown that thinned stands have much higher tree survival and lower carbon losses in a crown fire (Hurteau et al. 2008) or have used modeling to estimate lower carbon losses from thinned stands if they were to burn (Finkral and Evans 2008, Hurteau and North 2009, Stephens et al. 2009). However, other stand-level studies have not shown a carbon benefit from fuel treatments (Reinhardt et al. 2010), and evidence from landscape-level modeling suggests that fuel treatments in most forests will decrease carbon (Harmon et al. 2009, Mitchell et al. 2009) even if the thinned trees are used for biomass energy. Because the occurrence of fires cannot be predicted at the stand level, treating forest stands without accounting for the probability of stand-replacing fire could result in lower carbon stocks than in untreated stands (Hanson et al. 2009, Mitchell et al. 2009). More research is urgently needed to resolve these different conclusions because thinning to reduce fuel is a widespread forest management practice in the United States (Battaglia et al. 2010).

Also, Lutz et al., 2018 (co-authored by dozens of scientists) "recommend managing forests for conservation of existing large-diameter trees or those that can soon reach large diameters as a simple way to conserve and potentially enhance ecosystem services." DeLuca, 2009 points to research that "showed that if the objective of management is carbon storage, old-growth forests are better left standing. …Old growth, rather than being thought of as stagnant with respect to carbon fixation, can sequester atmospheric carbon dioxide long past the achievement of old-growth conditions."

Law et al. (2022), in a paper entitled "Creating Strategic Reserves to Protect Forest Carbon and Reduce Biodiversity Losses in the United States" assert that "many of the current and proposed forest management actions in the United States are not consistent with climate goals, and that preserving 30 to 50% of lands for their carbon, biodiversity and water is feasible, effective, and necessary for achieving them."

Moomaw and Smith, 2017 conclude:

> With the serious adverse consequences of a changing climate already occurring, it is important to broaden our view of sustainable forestry to see forests …as complex ecosystems that provide valuable, multiple life-supporting services like clean water, air,

flood control, and carbon storage. We have ample policy mechanisms, resources, and funding to support conservation and protection if we prioritize correctly.

…We must commit to a profound transformation, rebuilding forested landscapes that sequester carbon in long-lived trees and permanent soils. Forests that protect the climate also allow a multitude of species to thrive, manage water quality and quantity and protect our most vulnerable communities from the harshest effects of a changing climate.

Protecting and expanding forests is not an "offset" for fossil fuel emissions. To avoid serious climate disruption, it is essential that we simultaneously reduce emissions of carbon dioxide from burning fossil fuels and bioenergy along with other heat trapping gases and accelerate the removal of carbon dioxide from the atmosphere by protecting and expanding forests. It is not one or the other. It is both!

Achieving the scale of forest protection and restoration needed over the coming decades may be a challenging concept to embrace politically; however, forests are the only option that can operate at the necessary scale and within the necessary time frame to keep the world from going over the climate precipice. Unlike the fossil fuel companies, whose industry must be replaced, the wood products industry will still have an important role to play in providing the wood products that we need while working together to keep more forests standing for their climate, water, storm protection, and biodiversity benefits.

It may be asking a lot to "rethink the forest economy" and to "invest in forest stewardship," but tabulating the multiple benefits of doing so will demonstrate that often a forest is worth much more standing than logged. Instead of subsidizing the logging of forests for lumber, paper and fuel, society should pay for the multiple benefits of standing forests. It is time to value U.S. forests differently in the twenty-first century. We have a long way to go, but there is not a lot of time to get there.

Climate change and its consequences are effectively irreversible which implicates certain legal consequences under NEPA and NFMA and ESA (e.g., 40 CFR § 1502.16; 16 USC §1604(g); 36 CFR §219.12; ESA Section 7; 50 CFR §§402.9, 402.14). All net carbon emissions from logging represent "irretrievable and irreversible commitments of resources."

The FS doesn't recognize or analyze highly relevant information or even consider scientific information that questions its underlying assumptions and makes them scientifically controversial. This is compounded by the multitude of timber sales in the NPCNF, which represent cumulative effects that could be analyzed for carbon sequestration and global warming impacts at local and regional levels.

Buotte et al. (2020) prioritized forest lands for preservation based on "carbon priority ranking with measures of biodiversity." This is new and important information that the FS must consider. The researchers mapped "high carbon priority forests in the western US exhibit features of older, intact forest with high structural diversity…, including carbon density and tree species richness." Below is the map from that research article:

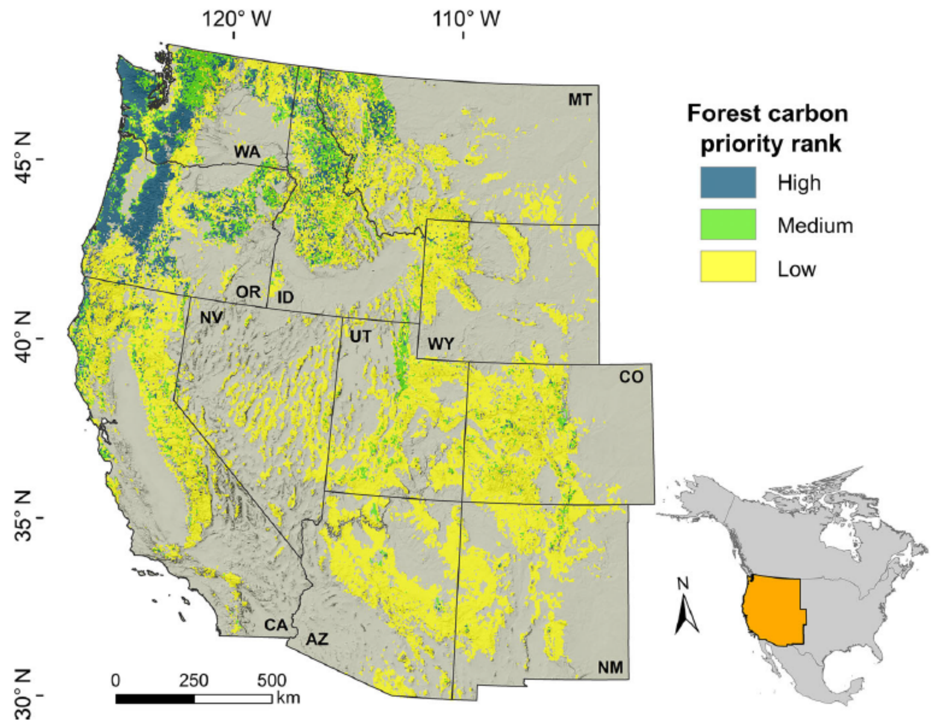


FIG. 1. Forested land in the western conterminous United States classified into priority for preservation to mitigate climate change based on the spatial co-occurrence of low vulnerability to drought and fire and low, medium, and high potential carbon sequestration. WA, Washington; ID, Idaho; MT, Montana; OR, Oregon; CA, California; NV, Nevada; UT, Utah; CO, Colorado; AZ, Arizona; NM, New Mexico.

Buotte et al. (2019) ranks the NPCNF at medium, with pockets of high. This Forest's potential to sequester carbon is significant. Similarly, see Profita (2020).

Depro et al., 2008 found that ending commercial logging on U.S. national forests and allowing forests to mature instead would remove an additional amount of carbon from the atmosphere equivalent to 6 percent of the U.S. 2025 climate target of 28 percent emission reductions.

Forest recovery following logging and natural disturbances are usually considered a given. But forests have recovered under climatic conditions that no longer exist. Higher global temperatures and increased levels of disturbance are contributing to greater tree mortality in many forest ecosystems, and these same drivers can also limit forest regeneration, leading to vegetation type conversion. (Bart et al., 2016.)

Law and Harmon, 2011 conducted a literature review and concluded:

> Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO2 to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment.

Best available science supports the proposition that forest policies must shift away from logging if carbon sequestration is prioritized.4 Forests must be preserved indefinitely for their carbon storage value. Forests that have been logged should be allowed to convert to eventual old-growth condition. Such management has the potential to double the current level of carbon storage in some regions. (See Harmon and Marks, 2002; Harmon, 2001; Harmon et al., 1990; Homann et al., 2005; Law, 2014; Solomon et al., 2008; Turner et al., 1995; Turner et al., 1997; Woodbury et al., 2007.)

Moomaw and Smith, 2017 state:

> Multiple studies warn that carbon emissions from soil due to logging are significant, yet under-reported. One study found that logging or clear-cutting a forest can cause carbon emissions from soil disturbance for up to fifty years. Ongoing research by an N.C. State University scientist studying soil emissions from logging on Weyerhaeuser land in North Carolina suggests that "logging, whether for biofuels or lumber, is eating away at the carbon stored beneath the forest floor."

Moomaw and Smith, 2017 examined the scientific evidence implicating forest biomass removal as contributing to climate change:

> All plant material releases slightly more carbon per unit of heat produced than coal. Because plants produce heat at a lower temperature than coal, wood used to produce electricity produces up to 50 percent more carbon than coal per unit of electricity.
>
> Trees are harvested, dried, and transported using fossil fuels. These emissions add about 20 percent or more to the carbon dioxide emissions associated with combustion.

Keith et al., 2009 state:

> Both net primary production and net ecosystem production in many old forest stands have been found to be positive; they were lower than the carbon fluxes in young and mature stands, but not significantly different from them. Northern Hemisphere forests up to 800 years old have been found to still function as a carbon sink. Carbon stocks can continue to accumulate in multi-aged and mixed species stands because stem respiration rates decrease with increasing tree size, and continual turnover of leaves, roots, and woody material contribute to stable components of soil organic matter. There is a growing body of evidence that forest ecosystems do not necessarily reach an equilibrium between assimilation and respiration, but can continue to accumulate carbon in living biomass, coarse woody debris,

[4] "More logging and reforestation occur annually in the U.S., including on our public lands, than in any other nation in the world." John Muir Project of Earth Island Institute 2018. *Protecting Forests from Logging: The Missing Piece Necessary to Combat Climate Change. See also* Hansen et al 2013 High-resolution Global Maps of 21st-Century Forest Cover Change. Science 342: 850-853; Prestemon, J.P., et al. 2015. The global position of the U.S. forest products industry.

> and soils, and therefore may act as net carbon sinks for long periods. Hence, process-based models of forest growth and carbon cycling based on an assumption that stands are even-aged and carbon exchange reaches an equilibrium may underestimate productivity and carbon accumulation in some forest types. Conserving forests with large stocks of biomass from deforestation and degradation avoids significant carbon emissions to the atmosphere. Our insights into forest types and forest conditions that result in high biomass carbon density can be used to help identify priority areas for conservation and restoration.

Hanson, 2010 addresses some of the false notions often misrepresented as "best science" by agencies, extractive industries and the politicians they've bought:

> Our forests are functioning as carbon sinks (net sequestration) where logging has been reduced or halted, and wildland fire helps maintain high productivity and carbon storage.
>
> Even large, intense fires consume less than 3% of the biomass in live trees, and carbon emissions from forest fires is only tiny fraction of the amount resulting from fossil fuel consumption (even these emissions are balanced by carbon uptake from forest growth and regeneration).
>
> "Thinning" operations for lumber or biofuels do not increase carbon storage but, rather, reduce it, and thinning designed to curb fires further threatens imperiled wildlife species that depend upon post-fire habitat.

Campbell et al., 2012 also refutes the notion that fuel-reduction treatments increase forest carbon storage in the western US:

> It has been suggested that thinning trees and other fuel-reduction practices aimed at reducing the probability of high-severity forest fire are consistent with efforts to keep carbon (C) sequestered in terrestrial pools, and that such practices should therefore be rewarded rather than penalized in C-accounting schemes. By evaluating how fuel treatments, wildfire, and their interactions affect forest C stocks across a wide range of spatial and temporal scales, we conclude that this is extremely unlikely. Our review reveals high C losses associated with fuel treatment, only modest differences in the combustive losses associated with high-severity fire and the low-severity fire that fuel treatment is meant to encourage, and a low likelihood that treated forests will be exposed to fire. Although fuel-reduction treatments may be necessary to restore historical functionality to fire-suppressed ecosystems, we found little credible evidence that such efforts have the added benefit of increasing terrestrial C stocks.

Mitchell et al. (2009) also refutes the assertion that logging to reduce fire hazard helps store carbon, and conclude that although thinning can affect fire, management activities are likely to remove more carbon by logging than will be stored by trying to prevent fire.

Harmon, 2009 is the written record of "Testimony Before the Subcommittee on National Parks, Forests, and Public Lands of the Committee of Natural Resources for an oversight hearing on The Role of Federal Lands in Combating Climate Change." The author "reviews, in terms as simple as possible, how the forest system stores carbon, the issues that need to be addressed when assessing any proposed action, and some common misconceptions that need to be avoided." His testimony begins, "I am here to …offer my expertise to the subcommittee. I am a professional scientist, having worked in the area of forest carbon for nearly three decades. During that time I have conducted numerous studies on many aspects of this problem, have published extensively, and provided instruction to numerous students, forest managers, and the general public."

Climate change science suggests that logging for sequestration of carbon, logging to reduce wild fire, and other manipulation of forest stands does not offer benefits to climate. Rather, increases in carbon emissions from soil disturbance and drying out of forest floors are the result. The FS must minimize manipulation of forest stands, especially stands that have not been previously logged, allowing natural processes to function. Furthermore, logging involves the burning of fossil fuels. Reducing fossil fuel combustion is vital. Everything from travel planning to monitoring would have an important impact in that realm.

Large trees serve as important carbon capture and storage (Stephenson et al. 2014). Also see DellaSala and Baker, 2020 and Scientists Letter, 2020. Additionally, forest canopies can buffer climate extremes and promote microclimates that in turn provide refugia for species in the understory—on a daily basis, buffering is most strongly related to forest cover. (Davis et al. 2019b.)

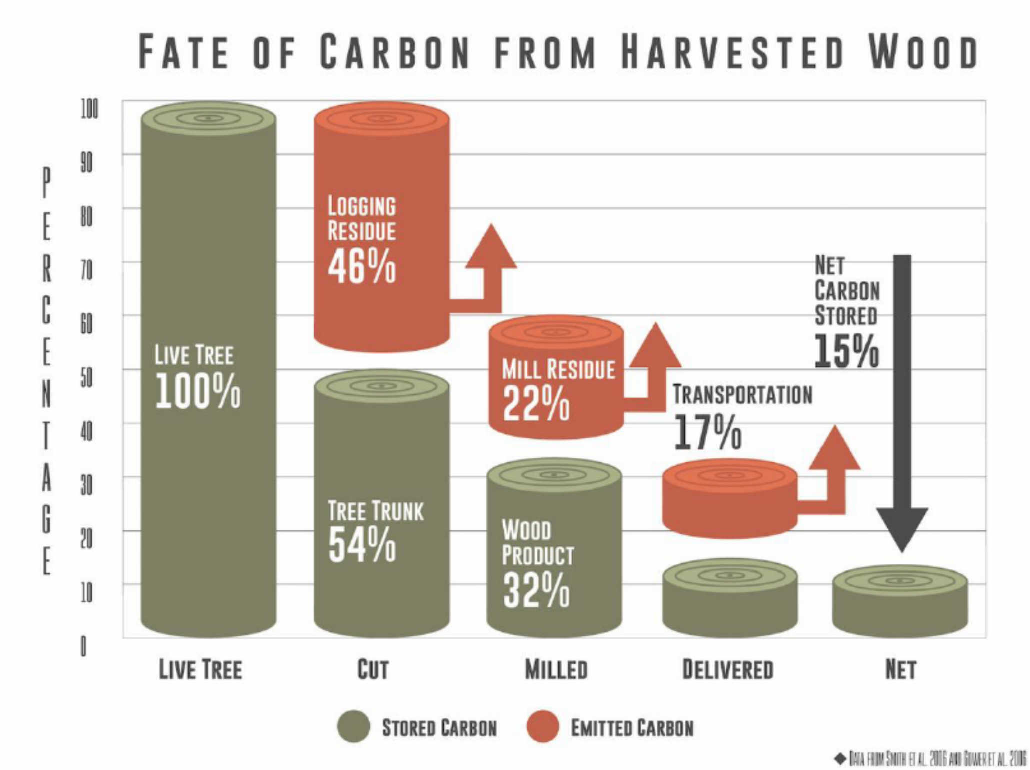
Given the urgency of preventing additional greenhouse gas emissions and continuing carbon sequestration to mitigate climate change, it would be best to protect large trees for their carbon stores, and also for their co-benefits of habitat for biodiversity, resilience to drought and fire, and microclimate buffering under future climate extremes.

Achat et al. 2015 state, "Compared with other terrestrial ecosystems, forests store some of the largest quantities of carbon per surface area of land." Much stored carbon is within soils. (Id.) Forest management can modify soil organic carbon stocks, losing soil organic carbon when comparing conventional harvests like clearcutting or shelterwood cutting with unharvested forests. (Id.) Not only does it lose the carbon stored in the soils, but cutting trees eliminates the trees' potential to continue to sequester carbon. (Id.)

Recent studies agree that maintaining forests rather than cutting them down can help reduce the impacts of climate change. E.g., Moomaw, et al., 2019: "Stakeholders and policy makers need to recognize that **the way to maximize carbon storage and sequestration is to grow intact forest ecosystems where possible**." (Emphasis added). Another report (Hudiburg et al., 2019) concludes:

> **Allowing forests to reach their biological potential for growth and sequestration, maintaining large trees** (Lutz et al 2018), reforesting recently cut lands, and afforestation of suitable areas **will remove additional CO2 from the atmosphere**. Global vegetation stores of carbon are 50% of their potential including western forests because of harvest activities (Erb et al 2017). Clearly, western forests could do more to address climate change through carbon sequestration **if allowed to grow longer**. (Emphasis added.)

The below graphic is from the Josephine County Democrats Webpage, Forest Defense is Climate Defense (https://josephinedemocrats.org/forest-defense-is-climate-defense/), where the illustrator used the information in Gower (2003) and Smith et al. 2006 to create the following illustration of how carbon is lost into the atmosphere from logging.



The importance of trees for carbon capture will rise especially if, as recent evidence suggests, hopes for soils as a carbon sink may be overly optimistic. (He et al., 2016) Such a potentially reduced role of soils doesn't mean that forest soils won't have a role in capture and storage of carbon, rather it puts more of the onus on aboveground sequestration by trees, even if there is a conversion to unfamiliar mixes of trees.

Forests affect the climate, climate affects the forests, and there's been increasing evidence of climate triggering forest cover loss at significant scales (Breshears et al. 2005), forcing tree species into new distributions "unfamiliar to modern civilization" (Williams et al. 2012), and raising a question of forest decline across the 48 United States (Cohen et al. 2016).

In 2012 Forest Service scientists reported, "Climate change will alter ecosystem services, perceptions of value, and decisions regarding land uses." (Vose et al. 2012.)

The 2014 National Climate Assessment chapter for the Northwest is prefaced by four "key messages" including this one: "The combined impacts of increasing wildfire, insect outbreaks, and tree diseases are already causing widespread tree die-off and are virtually certain to cause additional forest mortality by the 2040s and long-term transformation of forest landscapes.

Under higher emissions scenarios, extensive conversion of subalpine forests to other forest types is projected by the 2080s." (Mote et al. 2014.)

Managing forest lands with concerns for water will be increasingly difficult under new conditions expected for the 21st century. (Sun and Vose, 2016.) Already, concerns have focused on new extremes of low flow in streams. (Kormos et al. 2016.) The 2014 National Climate Assessment Chapter for the Northwest also recognizes hydrologic challenges ahead: "Changes in the timing of streamflow related to changing snowmelt are already observed and will continue, reducing the supply of water for many competing demands and causing far-reaching ecological and socioeconomic consequences." (Mote et al. 2014.)

Malmsheimer et al. 2008 state, "Forests are shaped by climate. Along with soils, aspect, inclination, and elevation, climate determines what will grow where and how well. Changes in temperature and precipitation regimes therefore have the potential to dramatically affect forests nationwide."

Kirilenko and Sedjo, 2007 state "The response of forestry to global warming is likely to be multifaceted. On some sites, species more appropriate to the climate will replace the earlier species that is no longer suited to the climate."

Some FS scientists recognize this changing situation, for instance Johnson, 2016:

> Forests are changing in ways they've never experienced before because today's growing conditions are different from anything in the past. The climate is changing at an unprecedented rate, exotic diseases and pests are present, and landscapes are fragmented by human activity often occurring at the same time and place.
>
> The current drought in California serves as a reminder and example that forests of the 21st century may not resemble those from the 20th century. "When replanting a forest after disturbances, does it make sense to try to reestablish what was there before? Or, should we find re-plant material that might be more appropriate to current and future conditions of a changing environment?
>
> "Restoration efforts on U.S. Forest Service managed lands call for the use of locally adapted and appropriate native seed sources. The science-based process for selecting these seeds varies, but in the past, managers based decisions on the assumption that present site conditions are similar to those of the past.
>
> "This may no longer be the case."

Westerling, et al. 2006 state:

> Robust statistical associations between wildfire and hydro-climate in western forests indicate that increased wildfire activity over recent decades reflects sub-regional responses to changes in climate. Historical wildfire observations exhibit an abrupt transition in the mid-1980s from a regime of infrequent large wildfires of short (average of one week) duration to one with much more frequent and longer-burning (five weeks) fires. This

> transition was marked by a shift toward unusually warm springs, longer summer dry seasons, drier vegetation (which provoked more and longer-burning large wildfires), and longer fire seasons. Reduced winter precipitation and an early spring snowmelt played a role in this shift. Increases in wildfire were particularly strong in mid-elevation forests. …The greatest increases occurred in mid-elevation, Northern Rockies forests, where land-use histories have relatively little effect on fire risks, and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt.

Running, 2006 cites model runs of future climate scenarios from the 4th Assessment of the Intergovernmental Panel on Climate Change, stating:

> (S)even general circulation models have run future climate simulations for several different carbon emissions scenarios. These simulations unanimously project June to August temperature increases of 2° to 5°C by 2040 to 2069 for western North America. The simulations also project precipitation decreases of up to 15% for that time period (*11*). Even assuming the most optimistic result of no change in precipitation, a June to August temperature increase of 3°C would be roughly three times the spring-summer temperature increase that Westerling *et al.* have linked to the current trends. Wildfire burn areas in Canada are expected to increase by 74 to 118% in the next century (*12*), and similar increases seem likely for the western United States.

The Pacific Northwest Research Station, 2004 recognizes "(a) way that climate change may show up in forests is through changes in disturbance regimes—the long-term patterns of fire, drought, insects, and diseases that are basic to forest development."

The District Court of Montana ruled in Case 4:17-cv-00030-BMM that the Federal government was required to evaluate the climate change impacts of the federal government coal program.

In March 2019, U.S. District Judge Rudolph Contreras in Washington, D.C., ruled that when the U.S. Bureau of Land Management (BLM) auctions public lands for oil and gas leasing, officials must consider emissions from past, present and foreseeable future oil and gas leases nationwide.

In March of 2018 the Federal District Court of Montana found the Miles City (Montana) and Buffalo (Wyoming) Field Office's Resource Management Plans unlawfully overlooked climate impacts of coal mining and oil and gas drilling. The case was brought by Western Organization of Resource Councils, Montana Environmental Information Center, Powder River Basin Resource Council, Northern Plains Resource Council, the Sierra Club, and the Natural Resources Defense Council.

Van der Werf, et al. 2009 discuss the effects of land-management practices and state:

> (T)he maximum reduction in CO2 emissions from avoiding deforestation and forest degradation is probably about 12% of current total anthropogenic emissions (or 15% if peat degradation is included) - and that is assuming, unrealistically, that emissions from deforestation, forest degradation and peat degradation can be completely eliminated.

> ...reducing fossil fuel emissions remains the key element for stabilizing atmospheric CO2 concentrations.
>
> (E)fforts to mitigate emissions from tropical forests and peatlands, and maintain existing terrestrial carbon stocks, remain critical for the negotiation of a post-Kyoto agreement. Even our revised estimates represent substantial emissions ...

In the face of increasing climate risk, growing impacts of wildfire and insect activity, plus scientific research findings, the FS must disclose the significant trend in post-fire regeneration failure. The FEIS fails to do so. The national forests have already experienced considerable difficulty restocking on areas that have been subjected to clear-cut logging, post-fire salvage logging and other even-aged management "systems." NFMA (1982) regulation 36 CFR 219.27(c)(3) implements the NFMA statute, and requires restocking in five years.

Vegetation management efforts that propose attempting to replicate pre-European conditions ignores the larger pattern of climate, ignores climate change, and ignores natural succession. Millar and Wolfenden 1999 discuss important patterns within the context of climate change.

The FS (in USDA Forest Service, 2017b) discusses some effects of climate change on forests, including the following statement "In many areas, it will no longer be possible to maintain vegetation within the historical range of variability. Land management approaches based on current or historical conditions will need to be adjusted." Yet, the FEIS lacks any acknowledgement, awareness or analysis that achieving the desired conditions is very much climate dependent. The FEIS has no scientific basis to support its assumption that proposed "treatments" will result in sustainable vegetation conditions under increasing temperatures.

Furthermore, the FS doesn't present a scientific basis to support its assumption that proposed "treatments" will result in sustainable vegetation conditions under increasing temperatures. Browne et al., 2019 discussed that adaptational lag to temperature in valley oak (Quercus lobata) can be mitigated by genome-informed assisted gene flow. Even using seed source from local species may not hold for management practices because trees can lag in adapting to temperature. This has not been accounted for.

The FSEIS/FEIS fails to consider that the effects of climate change on the project area, including that the target "historical" or desired vegetation conditions will likely not be achievable or sustainable. The FS fails to provide any credible analysis as to how realistic and achievable its objectives are in the context of a rapidly changing climate, along an unpredictable but definitely changing trajectory.

The FS fails to analyze and disclose how climate change is already, and is expected to be even more in the future, influence forest ecology. This has vast ramifications as to whether or not the forest in the project area will respond as the FS assumes.

There is scientific certainty that climate change has reset the deck for future ecological conditions. For example, Sallabanks, et al., 2001:

> (L)ong-term evolutionary potentials can be met only by accounting for potential future changes in conditions. …Impending changes in regional climates …have the capacity for causing great shifts in composition of ecological communities.

Conventional wisdom dictates that forests regenerate and recover from wildfire, and that forests can regenerate and recover from logging. And these days, "resilience" is a core tenant of FS planning. Unfortunately, assumptions relating to historic and desired conditions are incorrect. NEPA requires a "hard look" at the best available science relating to future concentrations of greenhouse gases and gathering climate risk as we move forward into an increasingly uncertain and uncharted climate future. This has not been done. The FEIS does not include a legitimate climate-risk analysis, much less one based on the best available science.

No amount of logging, thinning and prescribes burning will cure the cumulative effects (irretrievable loss) already baked into the foreseeably impending climate chaos. "Treatments" must be acknowledged for what they are: adverse cumulative environmental effects. Logging can neither mitigate, nor prevent, the effects of wildfire or logging. Both disturb forests, and the assumed resilience no longer exists. It is way too late ignore the elephant in the room.

The FEIS fails to consider that the effects of climate change on the Hungry Ridge project area, including that FS target NRV or desired vegetation conditions will likely not be achievable or sustainable. The FS is obligated to conduct an analysis as to how realistic and achievable its objectives are in the context of a rapidly changing climate, along an unpredictable but definitely changing trajectory.

The FSEIS states:

> (T)herefore this EIS analysis will primarily rely on earlier CEQ guidance on considering climate change in NEPA (CEQ 2016). For example, this analysis does not include all new recommendations such as applying social cost of GHG estimates to the incremental metric tons of each individual type of GHG emissions expected from the proposed action and its alternatives. … This analysis incorporates by reference the Nez Perce-Clearwater carbon white paper (Hoang et al 2020). We consider the carbon white paper a quantitative analysis using the best science and tools to understand our contribution to the carbon cycle.

Hoang et al. (2020) was not cited in the FEIS. So the FS says the scope of the Supplemental EIS is only about old growth, then pulls this stunt. The full cite is: "Hoang, Linh and Megan Lucas, Alexa Dugan, Duncan McKinley. 2022. Forest Carbon Assessment for the Nez Perce-Clearwater National Forests in the Northern Region. USDA, Forest Service. 32p." So it's not been independently peer reviewed nor previously circulated for public review. As far as citing "CEQ 2016" which was not mentioned in the DSEIS, well, we cited it in our DSEIS comments and FSEIS Appendix F Table F-3 states, "This reference was given by commenters, but they did not provide specific reasons or context for the team to evaluate." And "How it was considered – Not considered." What a joke.

Requested Remedy:
Please choose the No Action Alternative. It's the only sane FEIS alternative, that wouldn't convert thousands of acres of efficient carbon-sequestering forest to a CO_2 source for over a decade to come, and so would be closest to responding the climate chaos crisis we're facing.

WOLVERINE

In our DSEIS comments, we incorporated Friends of the Clearwater et al.'s submission to the USFWS in response to its request for new information (Federal Register Vol. 87, No. 225, November 23, 2022) to update the Species Status Assessment (SSA) for the North American Wolverine. Please note the maps on page two of those comments identify the Hungry Ridge project area as being a part of the "Current Potential Extent" and 1827 - 2017 "Maximum Extent Occurrences." Those come from USFWS maps.

The USFWS has recently (September 2023) published an Addendum to the SSA, and the FS should take note that USFWS identifies the climate issue as an even greater problem for wolverine that it had previously.

MANAGEMENT INDICATOR SPECIES FISHER, PILEATED WOODPECKER, NORTHERN GOSHAWK, PINE MARTEN

As the FS realizes:

> The Nez Perce-Clearwater National Forests and southern Idaho Panhandle National Forests are **the primary areas that support fisher in the U.S. Forest Service Northern Region** (Raley, Lofroth, Truex, Yaeger, & Higley, 2012) (personal communication Sauder 2013, personal communication Schwartz 2013)." … Fishers are associated with areas of high cover and structural complexity in large tracts of mature and old-growth forests (Powell & Zielinski, 1994; Sauder & Rachlow, 2014; Schwartz, DeCesare, Jimenez, Copeland, & Melquist, 2013).

(Draft Revised Forest Plan, emphasis added.) The Draft EIS for that draft plan states:

> Fishers are a low-density predator found in mature to late-successional forests with high canopy closure and both live and dead large tree structure. They appear to select areas with higher amounts of coarse woody debris and den in large diameter trees or snags with cavities ((Heinemeyer, 1993; Jeffrey L. Jones, 1991; J. L. Jones & E. O. Garton, 1994; Weir & Harestad, 2003; Weir, Lofroth, & Phinney, 2011). Female fishers use large diameter snags with cavities for denning and have been reported to use a wide variety of tree species.

That same Draft EIS for the revised Forest Plan promotes a "coarse filter approach to providing ecological conditions that provide for the diversity and abundance of wildlife and **viable populations of Species of Conservation Concern** (which) is reflected in the vegetation desired conditions in plan components and alternatives for the revised Forest Plan" but admits "The coarse filter concept has not been subject to rigorous scientific testing." (Emphasis added.) It continues:

> The companion approach to the course filter of ecosystem diversity is the "fine filter" approach in which conservation strategies are used for individual species or groups of species to contribute to species diversity. The fine filter approach narrows the focus to those species that require ecological conditions that may not be provided through coarse filter plan components. This fine filter approach is reflected in the species-specific plan components for wildlife found in the draft Forest Plan.

In further discussing the FS's proposed fine filter approach, the Draft EIS for the revised Forest Plan continues:

> The development of management recommendations to maintain or restore ecological conditions was based on the historic range of variability and desired future conditions influenced by climate change. Movement toward the desired conditions for vegetation under the revised Forest Plan would provide for an array of ecological communities of sufficient size, structure, and distribution that is expected to maintain habitats for the vast majority of native species that occur on the Nez Perce-Clearwater.

That document describes what the FS identifies as the best tools to achieve the "fine filter" conditions that would maintain viable populations of wildlife such as fisher:

> By allowing natural disturbance to function nearer to historic conditions, the approximate quantity, quality, and pattern of wildlife habitat across the Nez Perce-Clearwater would be nearer to what the native species evolved with in this part of their range. By moving towards the conditions, they evolved with, ecological conditions to provide species viability would be maintained. Active restoration through mechanical treatments can help in moving towards the desired conditions. However, given the predicted budgets, this tool would have limited success in trending habitat towards the desired conditions. The tool that has the best chance of success is fire and natural disturbance, both active and passive restoration. Natural disturbance has greater influence over the rate at which the Nez Perce-Clearwater trends towards the desired conditions.

So the FS has recognized as part of its forest plan revision process that maintaining viable populations of fisher and other old-growth associated species depends upon the availability of something reasonably resembling the amount and distribution of habitat that such species evolved with, which would be the "desired conditions" that resemble the "historic range of variability." Yet as this Objection and our previous commentary concerning old growth and the Hungry Ridge project point out, the FS has no idea what the historic levels of old growth (as defined by the Forest Plan) were on this Forest, existing prior to the onset of cumulative management impacts. It would be reasonable to expect however, given the cumulative level of intense clearcutting and other logging on the Forest, old growth is well below the historic range of variability and therefore viability for these species is highly uncertain.

Yet instead of "allowing natural disturbance to function nearer to historic conditions" (Id.) as the wisest, Precautionary Principle approach, the FS proceeds down the path of old-growth destruction as exemplified by the Hungry Ridge project. The FS's doubtful viability problem is compounded by the fact that the agency has no valid, statistically sound estimates for population trends of its old-growth Management Indicator Species (MIS) on the Forest, because it has failed to conduct even close to the level of monitoring as directed by the Forest Plan, consistent with Forest Plan Wildlife and Fish Standard #3 which requires the FS to: "Monitor population levels of all Management Indicator Species on the Forest… ."

SOIL PRODUCTIVITY

"In the event of an extreme wildfire, SBS is likely to be high. High SBS is associated with consumption of pre-fire surface litter layers, fine roots within several inches of the soil surface, and even large tree roots deep into the soil. Soils may be loose, unable to bind together and retain water. These soils are very susceptible to erosion and often have high surface run-off during rainstorms. As a result, soil productivity would decline." The FS cannot cite the results of FS monitoring and/or studies of post-fire conditions following wildland fires on the Forest in recent decades, on which the FS is basing the above conclusion.

"The estimated DSD from the Proposed Action is expected to remain below the Forest Plan standard of 20% for all treatment units. Further, by implementing SDEs and ADEs, disturbance levels would be reduced, and recovery times would be shortened. After rehabilitation, DSD would not exceed 15% in any activity area." The FS cannot cite the results of FS monitoring and/or studies on the Forest upon which the FS is basing the "reduced" and "shortened" conclusions.

USDA Forest Service 2014a discusses and discloses the complexities of fire and management-induced changes on soils:

> Management activities can result in both direct and indirect effects on soil resources. Direct and indirect effects may include alterations to physical, chemical, and/or biological properties. Physical properties of concern include structure, density, porosity, infiltration, permeability, water holding capacity, depth to water table, surface horizon thickness, and organic matter size, quantity, and distribution. Chemical properties include changes in nutrient cycling and availability. Biological concerns commonly include abundance, distribution, and productivity of the many plants, animals, microorganisms that live in and on the soil and organic detritus.

The R-1 SQS and definition of DSD consider alterations to physical properties, but not chemical or biological properties. The R-1 SQS does not adequately consider best available science, in violation of NEPA. One of these biological properties is partly represented by naturally occurring organic debris from dead trees. The R1 SQS recognize the importance of addressing potential long-term soil impacts due to losses of large woody debris, but include only discretionary guidelines to address the issue.

Some chemical properties are discussed in Harvey et al., 1994, including:

> The ...descriptions of microbial structures and processes suggest that they are likely to provide highly critical conduits for the input and movement of materials within soil and between the soil and the plant. Nitrogen and carbon have been mentioned and are probably the most important. Although the movement and cycling of many others are mediated by microbes, sulfur phosphorus, and iron compounds are important examples.

> The relation between forest soil microbes and N is striking. Virtually all N in eastside forest ecosystems is biologically fixed by microbes... Most forests, particularly in the inland West, are likely to be limited at some time during their development by supplies of plant-available N. Thus, to manage forest growth, we must manage the microbes that add most of the N and that make N available for subsequent plant uptake. (Internal citations omitted.)

In our above section "OLD GROWTH AND OLD-GROWTH ECOSYSTEMS" Rose et al. (2001) touch on the cooperative nature of fungi and tree species, a natural process occurring within intact forest soils. We highlight:

> Mycorrhizae. Mycorrhiza, meaning fungus-root, is a symbiotic association of fungi with plant roots. The fungus improves nutrient and water availability to the host in exchange for energy derived from plant sugars. **Mycorrhizae are necessary for the survival of numerous tree families, including pine, hemlock, spruce, true fir, Douglas-fir, larch, oak, and alder.** Mycorrhizal associations are a source of nutrients to promote wood decay. By the time a log reaches more advanced stages of decomposition (Class 3) fungal colonization leads to the accumulation of nutrients in hyphae, rhizomorphs and sporocarps, especially for ectomycorrhizal fungi, where >90% of the fungal activity is associated with organic material. Ectomycorrhizal fungi decrease the ratio of carbon to nitrogen in decomposing wood, and mediate nutrient availability to plants while improving nutrient retention by forest ecosystems.

(Id., emphasis added.) There is practically nothing in FS management direction or in the Hungry Ridge FEIS analyses that consider how industrial management impacts these subtle but vital soil functions, processes, and structures. Below we cite some scientific information the FS needs to consider to integrate into its management to understand cumulative impacts on forest ecosystems.

Recent research reveals profound biological properties of forest soil ignored by the FS: "(R)esource fluxes through ectomycorrhizal (EM) networks are sufficiently large in some cases to facilitate plant establishment and growth. Resource fluxes through EM networks may thus serve as a method for interactions and cross-scale feedbacks for development of communities, consistent with complex adaptive system theory." (Simard et al., 2015.) The FS has never considered how management-induced damage to EM networks causes site productivity reductions.

The FS fails to consider the role of mycorrhizal fungi in maintaining ecological integrity. Mycorrhizal networks play important roles in mitigating the impacts of climate disruption to forest ecosystems. They facilitate regeneration of migrant species that are better adapted to warmer climates and primed for resistance against insect attacks. (Song et al. 2015.) To achieve these benefits all of the parts and processes of highly interconnected forest ecosystems must be preserved and protected.

Mycorrhizal fungi distribute photosynthetic carbon by connecting the roots of the same or different tree species in a network allowing each to acquire and share resources. Large mature trees become the hubs of the network and younger trees the satellite nodes.

Mycorrhizal networks transmit water, carbon, macronutrients, micronutrients, biochemical signals and allelochemicals from one tree to another, usually from a sufficient tree to a tree in need. This type of source-sink transfer has been associated with improved survivorship, growth and health of the needy recipient trees in the network.

Recognition of kin is also evident between established large hub trees and their seedlings and saplings. Hub trees shuttle their kin more micro-elements and support more robust mycorrhizal networks providing them with a competitive advantage. However, hub trees also share resources with strangers, suggesting these evolutionary mechanisms exist not just for individual species but also at the community level.

Injury to a tree from defoliation by an insect herbivore or by physically removing foliage results in the transmission of defense signals through the connecting mycorrhizal mycelium to neighboring trees. These neighbors respond with increased defense-gene expression and defense-enzyme activity, resulting in increased pest resistance.

In Douglas-fir, sudden injury to a hub tree not only increases defense enzymes of healthy neighbors but elicits a rapid transfer of photosynthate carbon to a healthy neighbor. This suggests that the exchange of biochemicals between trees elicits meaningful changes in the senders' and receivers' behavior that enables the community to achieve greater stability in the face of a changing climate. (Song et al. 2015.)

The complete omission of any consideration of mycorrhizal networks in the FEIS is a symptom of a narrow-minded vision of likely future scenarios that disregards the unpredictability of climate-driven change. Forest managers must use scenario building models to explore an envelope of probable futures that becomes wider the further forward one projects. (Lempert, 2002.) In this more multifaceted approach based on complex systems science, managers would quantify the likelihood of each scenario and then address the ranges of uncertainties in the ecological, social, and economic dimensions. (Filotas, et al., 2014).

While much of the science demonstrating the importance of mycorrhizal networks is recent, the concepts are not new. For example, the FS's own scientists (Harvey et al., 1994) invoked the relationship between chemical properties and biological properties: "Productivity of forest and rangeland soils is based on a combination of diverse physical, chemical and biological properties." Harvey et al., 1994 further expands on this (emphases added):

> **The Soil as a Biological Entity**
> Traditionally, some have viewed soil as inert and inanimate, and soil properties have often been perceived as distinctive but relatively unchanging—except for plant nutrients—and based on mineral constituents. The organic horizons have, until recently, been largely ignored. Soil microbes have also been ignored, except for a few high-profile organisms (such as soil-borne pathogens and mycorrhizal fungi). Predictions by forest growth models have keyed almost exclusively on vegetation, gross land form, and site characteristics—the aboveground characteristics of the last rotation were assumed to be the best indicator for predicting growth, ignoring soil and related soil-borne processes. If soil potential was

reduced, the assumption was that fertilizing could offset any damage. This approach has fostered a significantly overoptimistic view of the health and productivity potential for second generation forests (Gast and others 1991, Powers 1991).

Contemporary studies indicate that **soil quite literally resembles a complex living entity**, living and breathing through **a complex mix of interacting organisms-from viruses and bacteria, fungi, nematodes, and arthropods to groundhogs and badgers**. **In concert, these organisms are responsible for developing the most critical properties that underlie basic soil fertility, health, and productivity** (Amaranthus and others 1989, Harvey and others 1987, Jurgensen and others 1990, Molina and Amaranthus 1991, Perry and others 1987). **Biologically driven properties resulting from such complex interactions require time lines from a few to several hundreds of years to develop, and no quick fixes are available if extensive damages occur (Harvey and others 1987)**.

Microbial Ecology

The variety of organisms residing in forest soils are extensive; all contribute to soil development and function, some in very critical ways (Amaranthus and others 1989). Although this section concentrates on the microbes (primarily bacteria and fungi), we recognized that **several orders of insects, earthworms, and burrowing mammals make significant and sometimes critical contributions to organic matter decomposition, soil mixing, and microbe propagule movement within many forest soils** (Molina and Amaranthus 1991, Wilson 1987).

The numbers and biomass of microbes in forest soil can be staggering; for example 10 to 100 million bacteria and actinomycetes, 1000 to 100,000 fungal propagules, and several kilometers of hyphae (fungal strands) can be present in a single gram of soil (Bollen 1974). The biomass related to such numbers is also staggering. Old-growth Douglas-fir forests of the Pacific Northwest can contain 4200 kg/ha dry weight of fungal hyphae and 5400 kg/ha of ectomycorrhizal root tips alone (Fogel and others 1973). Bacterial biomass could equal or exceed fungal biomass, and **the total biomass of an inland cedar/hemlock forest should be very nearly comparable to a coastal Douglas-fir forest. Thus, microbial biomass in eastside forests could easily reach 10,000 kg/ha and are a force to consider in management methods.**

…The ...descriptions of microbial structures and processes suggest that they are likely to provide highly critical conduits for the input and movement of materials within soil and between the soil and the plant. Nitrogen and carbon have been mentioned and are probably the most important. Although the movement and cycling of many others are mediated by microbes, sulfur phosphorus, and iron compounds are important examples.

The relation between forest soil microbes and N[5] is striking. Virtually all N in eastside forest ecosystems is biologically fixed by microbes... Most forests, particularly in the inland West, are likely to be limited at some time during their development by supplies of plant-available N. Thus, to manage forest growth, we must manage the microbes that add

[5] Nitrogen

most of the N and that make N available for subsequent plant uptake. (Internal citations omitted.)

Nearly 30 years ago, Harvey et al., 1994 asked the following question: "Can individuals (or groups) parasitize one another, that is to say, move nutrients or photosynthate around within a stand to balance temporary shortfalls? Such movement has yet to be widely demonstrated, except in simple microcosms (Read and others 1985), but it seems likely, particularly on highly variable sites that include harsh or infertile environments (ferry and others 1989)." More recent research answers that question with a resounding **yes** (e.g. Simard et al., 2015; Gorzelak et al., 2015).

In regards to the profound **biological properties** of forest soil, Simard et al., 2015 conclude from their research on relationships between fungi and plants (how nutrient transfers are facilitated by fungal networks) state, "resource fluxes though ectomycorrhizal (EM) networks are sufficiently large in some cases to facilitate plant establishment and growth. Resource fluxes through EM networks may thus serve as a method for interactions and cross-scale feedbacks for development of communities, consistent with complex adaptive system theory." Simard et al., 2013 state, "Disrupting network links by reducing diversity of mycorrhizal fungi… can reduce tree seedling survivorship or growth (Simard et al, 1997a; Teste et al., 2009), ultimately affecting recruitment of old-growth trees that provide habitat for cavity nesting birds and mammals and thus dispersed seed for future generations of trees." Also, Gorzelak et al., 2015:

> …found that the behavioural changes in ectomycorrhizal plants depend on environmental cues, the identity of the plant neighbour and the characteristics of the (mycorrhizal network). The hierarchical integration of this phenomenon with other biological networks at broader scales in forest ecosystems, and the consequences we have observed when it is interrupted, indicate that underground "tree talk" is a foundational process in the complex adaptive nature of forest ecosystems.

The complex and vital relationship between soil fungi and plant nutrients should not be anything new to the FS. For example Amaranthus, Trappe, and Molina (in Perry, et al., 1989a) recognized "mycorrhizal fungus populations may serve as indicators of the health and vigor as indicators of the health and vigor as indicators of the health and vigor of other associated beneficial organisms. Mycorrhizae provide a biological substrate for other microbial processes."

Beiler et al., (2009) conclude the "mycorrhizal network architecture suggests an efficient and robust network, where large trees play a foundational role in facilitating conspecific regeneration and stabilizing the ecosystem."

In Simard et al., 2012, scientists focus:

> …on four themes in the recent literature: (1) the physical, physiological and molecular evidence for the existence of mycorrhizal networks, as well as the genetic characteristics and topology of networks in natural ecosystems; (2) the types, amounts and mechanisms of interplant material transfer (including carbon, nutrients, water, defence signals and allelochemicals) in autotrophic, mycoheterotrophic or partial mycoheterotrophic plants, with particular focus on carbon transfer; (3) the influence of mycorrhizal networks on plant

> establishment, survival and growth, and the implications for community diversity or stability in response to environmental stress; and (4) insights into emerging methods for modelling the spatial configuration and temporal dynamics of mycorrhizal networks, including the inclusion of mycorrhizal networks in conceptual models of complex adaptive systems. **We suggest that mycorrhizal networks are fundamental agents of complex adaptive systems (ecosystems) because they provide avenues for feedbacks and cross-scale interactions that lead to self-organization and emergent properties in ecosystems.** (Emphasis added.)

The dynamics of this mycorrhizal network extends well beyond an exchange of nutrients, into the essential nature and functioning of the ecosystem itself. The news blog *Return to Now* published an interview with ecologist Suzanne Simard ("Trees Talk to Each Other in a Language We Can Learn, Ecologist Claims") based upon her research. The blog states:

> What she discovered was a vast tangled web of hair-like mushroom roots — an information super highway allowing trees to communicate important messages to other members of their species and related species, such that the forest behaves as "a single organism." …(Trees) communicate by sending mysterious chemical and hormonal signals to each other via the mycelium, to determine which trees need more carbon, nitrogen, phosphorus and carbon, and which trees have some to spare, sending the elements back and forth to each other until the entire forest is balanced. "The web is so dense there can be hundreds of kilometers of mycelium under a single foot step," Simard says."

In the *Nautilus* science magazine article "Never Underestimate the Intelligence of Trees" Simard states:

> I've come to think that root systems and the mycorrhizal networks that link those systems are designed like neural networks, and behave like neural networks, and a neural network is the seeding of intelligence in our brains. …All networks have links and nodes. In the example of a forest, trees are nodes and fungal linkages are links. Scale-free means that there are a few large nodes and a lot of smaller ones. And that is true in forests in many different ways: You've got a few large trees and then a lot of little trees. A few large patches of old-growth forest, and then more of these smaller patches. This kind of scale-free phenomenon happens across many scales.
>
> I made these discoveries about these networks below ground, how trees can be connected by these fungal networks and communicate. But if you go back to and listen to some of the early teachings of the Coast Salish and the indigenous people along the western coast of North America, they knew that already. It's in the writings and in the oral history. The idea of the mother tree has long been there. The fungal networks, the below-ground networks that keep the whole forest healthy and alive, that's also there. That these plants interact and communicate with each other, that's all there. They used to call the trees the tree people. The strawberries were the strawberry people. Western science shut that down for a while and now we're getting back to it. … I think this work on trees, on how they connect and communicate, people understand it right away. It's wired into us to understand this. And I don't think it's going to be hard for us to relearn it.

Also see this phenomenon documented in:

- the film "Intelligent Trees"
- the TED Talk "How trees talk to each other"
- the YouTube video "Mother Tree" embedded within the Suzanne Simard "Trees Communicate" webpage
- the Jennifer Frazer article in *The Artful Amoeba*: "Dying Trees Can Send Food to Neighbors of Different Species via Wood-Wide Web"
- the Ferris Jabr article: "The Social Life of Forests"
- the *New York Times* article: "The Woman Who Looked at a Forest and Saw a Community"

More scientific research on this topic is found in Simard et al. (1997a), Simard (2009), & Simard (2018).

What this expanding body of scientific research reveals is that we can no longer view forest ecosystems as simply a collection of competing entities vying for limited resources, but also as a cooperative—a community—that exhibits what may be called "Forest Wisdom," with the following core elements:

- Cooperation and Connection: Forests are complex adaptive systems that cooperate and care for trees and other life forms by creating favorable conditions, resisting stress and fostering long life. Sharing for the greater good gives cooperating networks evolutionary advantages over competing individuals.
- Mother Trees: Trees communicate through vast underground fungal networks of hubs and links, sharing nutrients and water, resisting insects and disease and nourishing their progeny until they reach the light. Mother Trees (a term coined by Suzanne Simard), the most linked hub in this network, recognize and care for their young.
- Mindless Mastery: Tree intelligence is decentralized and underground. Thousands of root tips gather and assess data from the environment and respond in coordinated ways that benefit the entire forest. Forests achieve a "mindless mastery" through cooperation allowing them to respond in optimal ways to environmental challenges.
- Nature's Phoenix: Forests arise renewed like the mythological phoenix from patches of high-intensity fire to create snag forests as diverse as old-growth. Forests also successfully regenerate in heterogeneous and ecologically beneficial ways following large high-intensity fires.

Understanding Forest Wisdom means changing our perception of how forests function and abandoning the FS's entire "healthy forests" framework. Our forests are not sick, they do not need any chainsaw medicine. In fact, forests are cooperative systems that are essential for helping mitigate global climate disruption and addressing the biodiversity crisis we currently face.

The FS fails to recognize and consider the role of shared mycorrhizal networks and disclose how project activities will affect their function. Researchers are seeking answers to such questions. Sterkenberg et al. (2019) investigated the abundance and diversity of ectomycorrhizal (ECM) fungi following varying levels of logging, ranging from clearcutting to 100% retention (control treatment). They explain that ECM fungi "represent a large part of the biodiversity in boreal forests. They depend on carbohydrates from their host trees and are vital for forest production, as uptake of nutrients and water by the trees is mediated by the ECM symbiosis. ECM fungal mycelium forms a basis for soil food webs." The researchers conclude:

> Our results confirm the value of retaining trees in forest management as a measure to maintain ECM fungal biodiversity. There was a clear and positive relationship between the amount of retention trees and ECM fungal species richness as well as the relative abundance of ECM fungi in the total fungal community. Frequent ECM fungi are likely to withstand logging with at least 30% of the trees retained, but at reduced mycelial abundance in the soil. Although **clear-cutting cause ECM fungal communities to be strongly impoverished even with FSC requirements of tree retention met**, the most common species survive harvest. Higher levels of tree retention, that is, in continuous cover forestry, may counteract local extinctions also of less frequent species and thus support efforts to manage for sustained high ECM fungal diversity. **Several rare species, and species predominantly confined to old natural forests, appear to rarely re-establish after clear-cutting** and are hence red-listed. For the survival of these species, **protection of forests with high conservation values and forest management directed towards conservation needs are unequivocally needed**. (Emphases added.)

From "A powerful and underappreciated ally in the climate crisis? Fungi" by scientists Toby Kiers and Merlin Sheldrake:

> Globally, the total length of fungal mycelium in the top 10cm of soil is more than 450 quadrillion km: about half the width of our galaxy. These symbiotic networks comprise an ancient life-support system that easily qualifies as one of the wonders of the living world.
>
> Through fungal activity, carbon floods into the soil, where it supports intricate food webs – about 25% of all of the planet's species live underground. Much of it remains in the soil, making underground ecosystems the stable store of 75% of all terrestrial carbon. But climate change strategies, conservation agendas and restoration efforts overlook fungi and focus overwhelmingly on aboveground ecosystems. This is a problem: the destruction of underground fungal networks accelerates both climate change and biodiversity loss and interrupts vital global nutrient cycles.
>
> Fungi lie at the base of the food webs that support much of life on Earth. About 500m years ago, fungi facilitated the movement of aquatic plants on to land, fungal mycelium serving as plant root systems for tens of millions of years until plants could evolve their own. This association transformed the planet and its atmosphere – the evolution of plant-fungal partnerships coincided with a 90% reduction in the level of atmospheric carbon dioxide. Today, most plants depend on mycorrhizal fungi – from the Greek words for fungus (mykes) and root (rhiza) – which weave themselves through roots, provide plants with crucial nutrients, defend them from disease and link them in shared networks sometimes referred to as the "woodwide web". These fungi are a more fundamental part of planthood than leaves, wood, fruit, flowers or even roots.

> We are destroying the planet's fungal networks at an alarming rate. Based on current trends, more than 90% of the Earth's soil will be degraded by 2050. … Logging wreaks havoc below ground, decreasing the abundance of mycorrhizal fungi by as much as 95%, and the diversity of fungal communities by as much as 75%. A large study published in 2018 suggested that the "alarming deterioration" of the health of trees across Europe was caused by a disruption of their mycorrhizal relationships, brought about by nitrogen pollution from fossil fuel combustion and agricultural fertiliser.
>
> Mycorrhizal fungal networks make up between a third and a half of the living mass of soils and are a major global carbon sink.
>
> Mycorrhizal fungi are keystone organisms that support planetary biodiversity; when we disrupt them, we jeopardise the health and resilience of the organisms on which we depend. Fungal networks form a sticky living seam that holds soil together; remove the fungi, and the round washes away. Mycorrhizal networks increase the volume of water that the soil can absorb, reducing the quantity of nutrients leached out of the soil by rainfall by as much as 50%. They make plants less susceptible to drought and more resistant to salinity and heavy metals . They even boost the ability of plants to fight off attacks from pests by stimulating the production of defensive chemicals. The current focus on aboveground biodiversity neglects more than half of the most biodiverse underground ecosystems, because areas with the highest biodiversity aboveground are not always those with the highest soil biodiversity.

The FS fails to acknowledge the critical role mycorrhizal fungi networks play in sustaining forests or provide protections for mycorrhizal networks in programmatic planning and project planning for roads, logging, prescribed burns, recreation and livestock grazing. This ignores the purposes of NEPA and the biodiversity mandates of NFMA.

The scientists involved in research on ectomycorrhizal networks have discovered connectedness, communication, and cooperation between trees, traditionally viewed as separate competing organisms. Such connectedness is usually studied within single organisms, such as the interconnections in humans among neurons, sensory organs, glands, muscles, other organs, etc. necessary for individual survival. The tree farming mentality reflected in the FEIS fails to consider the ecosystem impacts from industrial management activities on this mycorrhizal network—or even acknowledge they exist. This management paradigm will inevitably destroy what it refuses to see.

The R-1 SQS and FEIS do not adequately account for long-term losses in site or land productivity due to noxious weed infestations caused by management actions. The Sheep Creek Salvage FEIS (USDA Forest Service, 2005a) states at p. 173:

> Noxious weed presence may lead to physical and biological changes in soil. Organic matter distribution and nutrient flux may change dramatically with noxious weed invasion. Spotted knapweed (*Centaurea biebersteinii D.C.*) impacts phosphorus levels at sites (LeJeune and Seastedt, 2001) and can hinder growth of other species with allelopathic mechanism. Specific to spotted knapweed, these traits can ultimately limit

native species' ability to compete and can have direct impacts on species diversity (Tyser and Key 1988, Ridenour and Callaway 2001).

USDA Forest Service, 2016a states, "Soil erosion or weed infestations are adverse indirect effects that can occur as a result any the above direct impacts. In both instances, serious land degradation can occur." The Soil Standards do not set any limitations on the total area that is infested by invasive plants in a project area at any given time, nor do they require disclosure of the extent of such weed invasions in a project area and the impacts such losses may have cumulatively on the Forest Service's ability to adequately restock the area within five years of harvest, as required by NFMA.

USDA Forest Service, 2015a indicates:

> Infestations of weeds can have wide-ranging effects. They can impact soil properties such as erosion rate, soil chemistry, organic matter content, and water infiltration. Noxious weed invasions can alter native plant communities and nutrient cycles, reduce wildlife and livestock forage, modify fire regimes, alter the effects of flood events, and influence other disturbance processes (S-16). As a result, values such as soil productivity, wildlife habitat, watershed stability, and water quality often deteriorate.

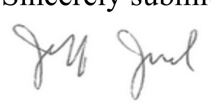
The FS has no idea how the productivity of the land been affected in the Hungry Ridge project area and forestwide due to noxious weed infestations, nor any trends. USDA Forest Service, 2005c states:

> Weed infestations are known to reduce productivity and that is why it is important to prevent new infestation sand to control known infestations. …Where infestations occur off the roads, we know that the **productivity of the land has been affected from the obvious vegetation changes**, and from the literature. The degree of change is not generally known. …(S)tudies show that productivity can be regained through weed control measures…

The FEIS does not cite the results or successes of weed control efforts. Nor is there any data considered regarding trends of invasive species, their causes, or cumulative effects.

In focusing only on a flawed DSD proxy, the FS avoids quantifying losses to and impacts on **soil productivity**, potentially leading to serious long-term reduction in growth of vegetation of all types, with resulting cascading impacts in food chains and ecosystem function.

Sincerely submitted,



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