VIA CARA AND ELECTRONIC MAIL

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Re: Comments on Draft Environmental Impact Statement for Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System

On behalf of the undersigned organizations, representing millions of members and supporters, thank you for the opportunity to comment on the Draft Environmental Impact Statement for Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System ("DEIS"). A clear intent of the National Old Growth Amendment ("NOGA") is to create a consistent management approach to maintain and develop old-growth forests while improving and expanding their distribution and abundance. The DEIS's purpose and need rightly recognizes the urgency of protecting the Nation's remaining old growth. That purpose and need also rightly points the Forest Service ("USFS" or "the agency") toward essential goals, especially those focused on expanding the abundance and distribution of old growth.

But the preferred alternative will fail to meet this intent or the purpose and need. It would, instead, reinforce the status quo regarding management of old growth on the National Forest System. This comment letter details the reasons for our significant concerns and offers recommendations for how the agency can course correct within the context of the EIS's analysis. With such correction, the agency could adopt a policy that realizes significant protections for our Nation's oldest forests and helps meet the promise of Executive Order 14072 to "conserve America's mature and old-growth forests on Federal lands."[1]

I. Introduction

The Administration has repeatedly acknowledged the essential role mature and old-growth trees and forests play in protecting ecosystems, fighting climate change,[2] and preserving biodiversity. It has elevated the unparalleled carbon sequestration and storage function of these forests, particularly infrequent-fire forests[3] such as those found in the Tongass National Forest and on the westside of the Cascade Range. And it has highlighted the Nation's extreme deficit of old-growth forests, particularly in Regions 8 and 9.

Consistent with this, the DEIS rightly highlights the essential function played by old-growth trees. It makes clear that these trees are a necessary feature of old-growth forests. It hammers home the carbon, biodiversity,

[1] Exec. Order No. 14072, Strengthening the Nation's Forests, Communities, and Local Economies, 87 Fed. Reg. 24,851, 24,851 (Apr. 27, 2022) ("E.O. 14072").
[2] *Id.*; USDA Forest Service, *Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System: Draft Environmental Impact Statement* 7–8 (June 2024) ("DEIS"); USDA Forest Service, *Climate Adaptation Plan* 14 (July 2022).
[3] "Infrequent-fire forests" means, following the DEIS, forests where fire-return intervals are greater than 35 years. And "frequent-fire forests" means forests where fire-return intervals are less than 35 years. USDA Forest Service, *Draft Ecological Impacts Analysis Report for the Draft EIS for Amendments to LMPs to Address Old-Growth Forests Across the NFS* 4 (June 2024) ("DEIAR") ("Historical disturbance regimes are derived from this [LANDFIRE] information, where areas with historic fire return intervals that are 35 years or less are described as 'Frequent' (i.e., FRG I and II) and 'Not Frequent' for fire return intervals greater than 35 years (i.e., FRG III, IV, and V).").

watershed integrity, and resilient features of these trees. And it elevates the role these trees play after death, becoming snags and coarse woody debris that continue to provide essential ecological values.

Unfortunately, the agency continues to approve numerous commercial logging projects that include old-growth logging components.[4] These projects destroy highly valued parts of the Nation's natural heritage, engender unnecessary conflict, and divert agency resources from priority issues.

To adopt a policy that meaningfully maintains and expands the Nation's old growth as provided in the DEIS's purpose and need,[5] the agency must adopt a modified Alternative 3 that:

- ends the commercial exchange of old-growth **trees**;
- bars cutting of old-growth **trees**, subject to very limited exceptions; and
- applies the same protections to infrequent-fire old-growth **stands**.

Drawing this distinction between stands and trees builds directly from existing old growth definitions and is essential for the amendment to achieve its purpose. But none of the standards currently elevate this essential bifurcation. Doing so will secure meaningful protections while allowing for appropriate, targeted management in frequent-fire forests. Logging old-growth trees and infrequent-fire old-growth stands is counterproductive, inefficient, and ineffective, and it is contrary to both best science and public opinion.

The agency must also take steps to ensure the proper functioning and efficacy of the final policy. In particular, it should ensure that these standards cannot be undercut by piecemeal and local amendment. It should close key loopholes in Standard 2 that would undermine the protections, particularly the language about de minimis use, prior authorizations, incidental cutting, and circumstances where the standard is not relevant or beneficial. And it should reinstate the non-degradation standard featured in the December 2023 Notice of Intent (NOI). As discussed below, all our proposed modifications are feasible within the frame of the current analysis.

And the agency should make clear that Tongass National Forest old growth is fully protected from commercial logging in a final policy. Though the DEIS deleted the Tongass-specific exemption that was in the NOI, some parts of the DEIS can be read to authorize continued commercial harvest of Tongass old growth,[6] notwithstanding other statements in the analysis suggesting that the preferred alternative would end the current commercial old growth logging program.[7]

Alternative 2—the agency's preferred policy—does not satisfy the DEIS's purpose and need. The DEIS states that a core purpose of the proposed action is to:

> Foster ecologically focused management across the National Forest System by maintaining and developing old-growth forests while improving and expanding their abundance and distribution and protecting them from the increasing threats posed by climate change, wildfire, insects and disease, encroachment pressures from urban development, and other potential stressors, within the context of the National Forest System's multiple-use mandate.[8]

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[4] Climate Forests Coalition. "Worth More Standing: 10 Climate-Saving Forests Threatened by Federal Logging" (2022). https://www.climate-forests.org/_files/ugd/73639b_03bdeb627485485392ac3aaf6569f609.pdf; Climate Forests Coalition. "America's Vanishing Climate Forests: How the U.S. Is Risking Global Credibility on Forest Conservation" (2022). https://www.climate-forests.org/_files/ugd/ae2fdb_b5a2315e3e8b42498b4c269730c3955a.pdf. *See also* Ruediger, L. "The Secret is out! Old-growth logging in the Secret timber sale, in the Briggs Creek Watershed." *The Siskiyou Crest* (Aug. 23, 2024). https://siskiyoucrest.com/2024/08/23/the-secret-is-out-old-growth-logging-on-the-secret-timber-sale-and-in-the-briggs-creek-watershed/.

[5] DEIS at 7–8.

[6] *Id.* at 33, 121.

[7] *Id.* at 106.

[8] *Id.* at 7.

Alternative 2 advances a proactive stewardship mandate that incorporates unnecessarily broad discretion to log and sell old growth. The agency asserts that the climate crisis warrants this broad discretion because that crisis exposes old-growth forests to higher risk of severe disturbance that threatens their permanent loss at an unprecedented pace.

But the DEIS itself demonstrates that this rationale does not justify the discretion built into Alternative 2. As we document below, the DEIS discloses that old-growth trees play an irreplaceable role in forest ecosystems. It discloses the importance of keeping old-growth forests intact, highlighting the resilience conferred by retaining their key elements. And it discloses that vegetation management to control the effects of climate change on old-growth forests is typically speculative at best. Taken together, this body of analysis indicates that targeted vegetation management in old-growth forests (but never cutting old-growth trees) can be helpful in certain forest types at certain times—such as cutting younger trees in frequent-fire forests where ecosystem processes have been impaired by prior logging, livestock grazing, and fire suppression. But, contrary to this, Alternative 2 enshrines an unjustifiably capacious proactive stewardship mandate that retains discretion to log in scenarios where both the DEIS's analysis and the scientific literature indicate it is least needed and most harmful to "maintaining and developing old-growth forests."

The remainder of this comment expands on and supports these core recommendations. Part II lays out our policy recommendations in more detail. Part III makes the case for protecting from logging old-growth trees and infrequent-fire old-growth stands. Part IV presents additional thoughts on actions the agency should take to ensure it is robustly pursuing old growth protection and expansion. And Part V articulates steps the agency should take to protect mature trees and forests, complementary to the old growth policy it is building with the DEIS.

II. Core Recommendations[9]

To meet the purpose and need by securing viable, meaningful protections for old growth, the agency must adopt an improved version of Alternative 3. The preferred alternative—Alternative 2—allows the agency to retain substantial discretion to log, wholly unsupported by the document's own analysis or the broader scientific literature. As discussed below, the DEIS fails to demonstrate that logging in infrequent-fire old-growth forests or any logging of old-growth trees is necessary to meet restoration or stewardship needs. Moreover, the DEIS—and the broader scientific literature—strongly supports the retention of these trees and forests.[10] Notwithstanding this analytic thrust, the standards in Alternative 2 would at best preserve the status quo under which old-growth trees and forests continue to be logged pursuant to various stewardship rationales. And by enshrining the scientifically indefensible rationales that the agency has long used to log old growth, Alternative 2 could even be used to justify an increase in current logging practices notwithstanding that a change in course is urgently needed to address the climate and biodiversity crises.

Of particular concern, Alternative 2 continues to allow the commercial logging of old-growth forests and trees, as long as timber production is not the stated management purpose. As commenters on the NOI noted, whatever "purpose" the agency articulates for logging old growth, the availability of commercial mechanisms would remain a powerful underlying motivation given the agency's incentives, notably the board-foot-quota performance-based standards.[11] It is already common practice for the agency to point to a non-timber purpose when logging old growth (and mature), even when a project results in timber production and is used by the agency to meet timber production goals.[12]

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[9] Throughout this part we illustrate how our recommendations should be implemented in text. Appendix B illustrates how these core recommendations would appear when incorporated as a modified Alternative 3. The Appendix also includes additional recommendations to improve and clarify other parts of the policy.
[10] *See infra* Part III.
[11] Center for Biological Diversity et al. Comments re: "Notice of Intent for Land Management Plan Direction for Old-Growth Forest Conditions Across the National Forest System" (Feb. 2, 2024).
[12] Complaint, *Chattooga Conservancy, et al. v. U.S. Dep't of Agric., et al.*, No. 24-cv-00518 (D.D.C. Feb. 26, 2024).

Alternative 3 needs major improvement to become a meaningful old growth conservation policy. The current version is significantly broader than what numerous public comments called for during the NOI process.[13] Specifically, as constructed it would bar commercial use of all trees within old-growth forest stands. It does not distinguish between frequent- and infrequent-fire forests and management approaches appropriate to those differences. The result is a strawman caricature that the agency heavily criticizes throughout the DEIS. Far from evincing a reasoned consideration of public comments, the DEIS presents—and dismisses—a distorted misrepresentation of those comments.

Nonetheless, the alternatives and scientific discussions in the DEIS provide a sufficient basis for finalizing a protective, scientifically supported old growth policy. Immediately below, we describe the essential components of that policy, and in Part III we detail their scientific basis.

A. Essential components of an old-growth policy

i. Core improvements to Alternative 3

1. Commercial exchange

Alternative 3 must be modified to focus on **barring the commercial exchange of old-growth trees** in any forest type and any trees from infrequent-fire old-growth stands, including through timber sales and goods-for-services contracts. This component simplifies old growth management decisions. It ensures that any consideration about old-growth tree cutting and removal is free from commercial or personnel performance pressures and any non-commercial cutting that occurs is restricted to very limited circumstances.[14] It also builds public confidence that such management is not being influenced by inappropriate factors. Conversely, if the Forest Service continues to engage in such commercial exchange, agency personnel will continue to be subject to competing pressures, and the public will lack assurance that the trees are being cut for the stated rationale, rather than for commercial purposes. Public trust in the agency will be further eroded.

This alteration would protect the myriad ecological values of these old-growth trees and forests, detailed in the DEIS and summarized below. It would also help preserve the critical role of dead (standing or fallen) old-growth trees in the ecosystem. Dead old-growth trees continue to provide a host of ecological benefits, including carbon storage, habitat creation, and water purification. These benefits accrue regardless of whether the trees persist as standing snags or coarse woody debris, and whether they died naturally or by human action.

This component differs in a critical way from the version of Standard 3 in the DEIS's Alternative 3. As written, that standard would prohibit all proactive stewardship in all old-growth forests in any forest type from resulting in commercial timber harvest.[15] By focusing protections more specifically on old-growth trees everywhere and infrequent-fire old-growth stands, this component would not prohibit commercial logging resulting from the management of younger trees in frequent-fire stands. In this sense, prohibiting the commercial exchange of old-growth trees is a scaled-down version of Alternative 3 and fully contained within the DEIS's range of alternatives.

2. Old-growth tree cutting

Additionally, Alternative 3 should **bar the cutting of old-growth trees in any forest type** except in very limited circumstances.[16] As the DEIS repeatedly discloses, old-growth trees deliver critical environmental and

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[13] *Id.*

[14] As used in this section, the term "very limited circumstances" references an imminent and demonstrated risk to public safety; requirements to effectuate a statute, a treaty, or trust obligations; and individual tree selection by Alaska Native and Native American Tribes for traditional and customary uses.

[15] DEIS at 53.

[16] As noted above, the term "very limited circumstances" references an imminent and demonstrated risk to public safety; requirements to effectuate a statute, a treaty, or trust obligations; and individual tree selection by Alaska Native and Native American Tribes for traditional and customary uses.

social attributes wherever they occur, regardless of forest type or the age of the surrounding forest. They provide unique habitat, sequester and store vast quantities of carbon, and are irreplaceable on any scale relevant to addressing the climate and biodiversity crises.

The agency's DEIS explains:

> [T]he presence of old trees, both within and outside of old-growth forests, represents a critical structural element that provides essential habitats for a diverse array of species and significantly contributes to carbon sequestration, biodiversity, and overall ecosystem resilience. The rarity of old trees in comparison to historical conditions, as well as their keystone ecological functions and services, highlight their conservation value.[17]

The agency also rightly acknowledges the role of old trees for "cultural heritage, traditional practices, and social values."[18]

The DEIS contains a disconnect between recognizing the importance of old-growth trees—whether in an old-growth stand, or outside of an old-growth stand—and failing to give them dedicated protection. Within old-growth forest stands, these trees are vulnerable to the same expansive rationales for logging as the forest as a whole. Outside of old-growth forest stands, the DEIS contains an overly permissive guideline, but does not include a standard conferring protection for these trees. Yet the DEIS does not present any compelling ecological need to cut them, even in situations when the agency asserts a need to conduct management activities in old-growth stands. Prohibiting the logging of old-growth trees, which the content of the DEIS conclusively supports, would enhance the internal consistency of the agency's policy.

3. Infrequent-fire old-growth stand cutting

The final policy must also **prohibit any cutting in infrequent-fire old-growth stands**, except in very limited circumstances.[19] As with old-growth trees, the DEIS contains no compelling ecological reason to log in old-growth stands where fire is infrequent. To protect the carbon storage, habitat creation, water purification, recreational opportunities, and social import of these stands, the agency must not log them.

Notably, many areas that experience fire infrequently—such as New England, the Central and Southern Appalachians, and the Upper Midwest—are particularly deficient in old growth due to a long history of overexploitation and other inappropriate vegetation management.[20] Compounding this historical injury, the DEIS would do little to nothing for many of these areas due to the extremely limited presence of remaining old growth. It is critical that the agency fully protect any old growth that exists in these areas. To be clear, this component would not apply to frequent-fire old-growth forests, where management of younger trees can sometimes be justified.

4. Recommended revised Standard 3

To reflect the foregoing recommendations, Standard 3 in Alternative 3 should be revised to read:

> **Vegetation management shall not result in:**
>
> 1. **Cutting of old-growth trees in any forest type or cutting of any trees in infrequent-fire old-growth forests, except (a) to abate a demonstrated, imminent risk to public**

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[17] DEIAR at 24.

[18] *Id.* at 25.

[19] As noted above, the term "very limited circumstances" references an imminent and demonstrated risk to public safety; requirements to effectuate a statute, a treaty, or trust obligations; and individual tree selection by Alaska Native and Native American Tribes for traditional and customary uses.

[20] Johnson, C. and D. Govatski. "Forests for the People: The Story of America's Eastern National Forests." *Island Press* (2013).

safety, (b) via tree selection for Native American or Alaska Native traditional and customary uses, or (c) as required to effectuate a statute or treaty; or

2. **Commercial timber harvest of old-growth trees in any forest type or any trees in infrequent-fire old-growth forests.**[21]

ii. Remove the authority to alter the national amendment's protections

The final policy must ensure that the national baseline standards reflected in these basic requirements are **not undercut by piecemeal and local amendment**. The agency should clearly state that authority to revise, amend, modify, or otherwise change the operative provisions of this policy—including the standards—resides exclusively with the Secretary.[22] (Because the NOGA allows for more restrictive plan-specific constraints on logging old-growth, such constraints would not require secretarial approval.) As it currently stands, the proposed action would allow plan-by-plan, forest-by-forest amendments that could weaken the protections provided by the national baseline amendment.[23] The amendment properly reflects that when local plans provide more restrictive constraints on management of old growth than those provided in the national amendment, those more restrictive constraints apply. But the same should not be true for local amendments that seek to weaken protection for old-growth trees or forests. Baseline national protections should preclude piecemeal future local forest amendments that would be largely hidden, as a practical matter, from national scrutiny.

iii. Close loopholes

In addition to the foregoing, the agency must close several significant loopholes.

1. Eliminating egregious loopholes in standard 2

The Forest Service should eliminate or narrow exceptions in the proposed amendment. As written, several of these exceptions are so broadly worded as to be readily susceptible to abuse. Indeed, the confusion about the Tongass discussed below highlights a useful signal about the ambiguities in some of these exceptions that could lead to abuse in the implementation of the rule.

a. Clarify the exception for incidental cutting of old growth

The exception in Standard 2.b about cutting old growth incidental to authorized activities other than restoration activities or timber harvest is unnecessary. Given that old growth is of overwhelming national importance in the contexts of the biodiversity and climate crises, the agency needs to prioritize old growth conservation over other activities. Such activities should be designed and implemented to avoid cutting old growth. To the extent the exception is retained, the language should be significantly clarified. The DEIS creates ambiguity in at least one location by suggesting that the exception could justify logging of old growth for a commercial purpose.[24] If retained, therefore, the exception must be clarified to preclude logging for commercial purposes or removal that results in commercial exchange. And it must be narrowed to require that cutting of old growth should only be permitted under this exception when there is no other reasonable way to design or conduct the otherwise authorized activities that would avoid old growth.

To reflect the foregoing recommendations, Standard 2.b should be revised to read:

> The cutting or removal of trees in old-growth forest for purposes other than proactive stewardship is permitted when (1) incidental to the implementation of a management activity not otherwise

[21] "Commercial timber harvest" here has the same meaning found the DEIS glossary: "**Commercial timber harvest:** For the purpose of the old-growth amendment and analysis, *commercial* timber harvest refers to the commercial exchange of wood products through the use of timber sale contracts, end result stewardship contracts, and agreements." DEIS at G-1.

[22] 36 C.F.R. § 219.2(b)(3).

[23] *See, e.g.*, DEIS at 17.

[24] *Id.* at 33.

prohibited by the plan, and (2) the area – as defined at an ecologically appropriate scale – continues to meet the definition and associated criteria for old-growth forest after the incidental tree cutting or removal. **Such cutting or removal shall not result in commercial timber harvest. Such cutting or removal may be permitted under this exception only when it has been demonstrated in the project's environmental review that there is no other reasonable way to design or conduct the otherwise authorized activities in a manner that would avoid cutting or removing old growth.**

b. Clarify the exception for prior authorizations

The proposed amendment contains an exception for vegetative management when necessary "to comply with … authorizations of occupancy and use made prior to the old growth amendment decision." The Forest Service should clarify that this exception only applies to authorizations made in the form of permits or contracts issued before the adoption of the amendment and not other more general agency policies. For example, the Forest Service in one part of the DEIS points to this exception as one that can be used to authorize commercial logging on the Tongass.[25] This could be read as suggesting that the exception encompasses the general policy direction in the current Southeast Alaska Sustainability Strategy ("SASS") rather than an actual contract or permit. Language creating such a vague and general exception would undercut the purposes of the national amendment.

To reflect the foregoing recommendations, Standard 2.c.iii should be revised to read:

iii. to comply with other statutes or regulations, valid existing rights for mineral and energy resources, or authorizations of occupancy and use **in the form of permits or contracts** made prior to the old-growth amendment decision.

c. Eliminate or narrow the "de minimis use" exception

The proposed amendment contains a new exception for "de minimis use for local community purposes," which is not defined in the proposal. The one specific example identified in the DEIS, firewood gathering,[26] is quite distinct from potential commercial or logging activity. Yet, as illustrated by the reference to this exception in some discussions of the Tongass,[27] the proposed exception is vague enough to be misused to, for example, authorize commercial logging in some form. Indeed, according to some language in the DEIS, the de minimis exception would apparently allow logging of 5 million board feet of old growth a year in the Tongass, and, by extension, any other national forest. Similarly, de minimis could be interpreted to include constructing local buildings—such as recreation cabins—from old growth. Given the wholly untethered nature of this exception, it unnecessarily creates the opportunity for field personnel—subject to incentives to log, such as those embodied in the agency's key performance indicators—to authorize old growth logging under a rationale that such logging is "merely" de minimis.

The exception is unnecessary for old-growth trees and should be eliminated, or at least limited to permit only firewood gathering of downed trees by individuals.

To reflect the foregoing recommendations, Standard 2.c.iv should be revised to read:

iv. for culturally significant uses as informed by tribes ~~**or for de minimis use for local community purposes**~~;

d. Eliminate the exception for circumstances when the standard is not relevant or beneficial

The exception in Standard 2.c.vi for cases where the amendment is "not relevant or beneficial to a particular species or forest ecosystem type" is vague and potentially subject to abuse. It is not clear from the DEIS why

[25] *See infra* Part II.a.iii.2.
[26] DEIS at 105.
[27] *See infra* Part II.a.iii.2.

this exception is necessary. If for disturbance or other natural reasons a forest type does not develop old growth conditions or trees, then the amendment would not have an effect on those stands and no exception is needed. As worded, the exception would allow too much discretion to the Forest Service to make an unbounded judgment that in some circumstances the amendment's protections do not apply.

As such, Standard 2.c.vi should be deleted.

e. Reinstate non-degradation standard

The agency must ensure that the old growth definitions themselves do not become loopholes. Currently, if an old-growth forest ceases to meet the agency's narrow definition of old growth, any protective standards stop applying. Alarmingly, this is true even if the change in status is due to Forest Service management activity. The DEIS explicitly acknowledges that field personnel can eliminate old growth—both stands and trees—in the process of implementing the proactive stewardship mandate.[28] And those management decisions are themselves tied to subjective determinations based on generally undefined and ambiguous criteria..[29]

This framework significantly undermines the effectiveness of any old growth policy. It creates perverse incentives to log old growth. It turns definitions designed to identify existing old growth into on-going thresholds for management decisions. And it runs counter to the purpose and need of the DEIS and E.O. 14072.

The agency must correct this. In particular, the final NOGA decision should guarantee that:

- The policy cannot be implemented in a manner that allows the agency to manage identified old-growth forests out of old growth status.
- Protections under the policy continue even if an identified old-growth forest falls out of the definition of old growth due to natural disturbance. Even if a stand does not meet the narrow definition of old growth after a disturbance, the old-growth trees and other legacy structural features should continue to be protected.
- Field personnel cannot manage an old-growth forest down to the minimum criteria for old-growth status as defined by the old growth definitions referenced in Standard 1.[30] Those definitions should be used purely for identification purposes, and not as guidelines or targets for management outcomes.

The DEIS states that Standard 2.a, stating that management in old growth "may only be for the purpose of" proactive stewardship, was redundant with an earlier requirement that management "must not degrade" old-growth forest.[31] But, as illustrated above, Standard 2.a would clearly allow for degradation. If the Forest Service's intent is to include the NOI's "non-degradation" standard, then it should reinstate that standard.

To correct this, we recommend that the DEIS reinstate Standard 1 from the NOI, with some modifications (bolded in red) as a new Standard 1, with subsequent standards being renumbered:

> Vegetation management activities must not degrade or impair the composition, structure, or ecological processes in a manner that prevents the **short- or** long-term persistence of old-growth forest conditions **at the site-specific** ~~within the plan~~ **area. The definitions and associated criteria used to identify old growth are not guidelines for management. Once an area has been identified as an old-growth forest, it will continue to be administered as such, including during periods when it is exhibiting other seral stages.**

[28] DEIS at 16–17.
[29] *Id.*
[30] DEIS at 28.
[31] *Id.*

The two new sentences are needed to implement our recommendations. We also recommend changing "within the plan area" to "at the site-specific area" to ensure meaningful application of the non-degradation standard. A clearer, focused construction of the non-degradation standard is needed because the original language would still allow degradation or elimination of old-growth stands, given that "long term persistence" of old-growth forest conditions within a plan area involves a highly subjective determination. Planning areas tend to be increasingly large—often much larger than the acres treated as part of a project. Absent changes to this standard, field personnel could eliminate or degrade old-growth stands as part of a project because, they may assert, there are other old-growth stands in the plan area that are not slated for degradation. And, indeed, field personnel could draw plan boundaries in a manner that facilitates such a workaround.

2. Tongass National Forest

As an initial matter, the Forest Service must eliminate the ambiguity in the DEIS about the Tongass National Forest. The agency has recognized the input from the public and from Alaska Native tribes in Southeast Alaska requesting deletion of the explicit Tongass old growth logging exception that was in the notice of intent.[32] Yet, as detailed below, the DEIS—and recent statements by Forest Service staff in the region—offer conflicting statements about the Forest Service's intended direction for old-growth forests in the Tongass.

The Tongass is the crown jewel of the National Forest System, containing some of the best and largest temperate old-growth forests left anywhere in the world. Eliminating all ambiguity about the protections accorded to the Tongass aligns with E.O. 14072. It matches the intent of the NOGA to "foster the long-term resilience of old-growth forests and their contributions to ecological integrity across the National Forest System."[33] And it supports national priorities to strengthen sustainable local economies, preserve regional biodiversity, and fight global climate change. Tongass old-growth trees are far more valuable standing then cut down, no matter the scale of logging.

a. The DEIS contradicts itself regarding old growth logging in the Tongass.

The DEIS is, at best, confusing and contradictory regarding whether the preferred alternative would end all old-growth logging in the Tongass with a commercial purpose, aligning with the requirements of the NOGA preferred alternative nationally, or if it would indefensibly continue to allow millions of board feet of commercial purpose old-growth logging annually. Several parts of the DEIS's analysis of Alternative 2 indicate that the Tongass is excluded from even the insufficient protections against logging with a commercial purpose that otherwise apply nationwide. But other portions of the text point in the opposite direction.

The discussion in one part of the DEIS of the implications of Alternative 2 for the Tongass, consistent with the elimination of the Tongass-specific exception, states Alternative 2 would end most commercial logging on the Tongass, "leaving commercial harvesting to occur within young or secondary growth areas"[34]:

> NOGA-FS-STD-03 in Alternatives 2 and 3 removes the option for most commercial timber harvest. It is therefore assumed that the small commercial sales [in the Tongass] would not occur under Alternatives 2 and 3, although there may be ecologically appropriate stewardship actions under NOGA-FS-STD 2a and non-commercial activities in accordance with the exceptions.[35]

Similarly, the DEIS in places describes the exceptions in ways that would preclude utilizing them to allow commercial purpose logging in the Tongass. The new exception for de minimis use of old growth is

[32] USDA Forest Service, Land Management Plan Direction for Old-Growth Forest Conditions Across the National Forest System, 88 Fed. Reg. 88,042, 88,047 (notice of intent published Dec. 20, 2023) ("NOI") ("Exceptions to standards 2 and 3 may be granted by the Regional Forester in Alaska if necessary to allow for implementation of the Southeast Alaska Sustainability Strategy and the rationale must be included in a decision document.").

[33] DEIS at S-1

[34] *Id.* at 106.

[35] *Id.*

sometimes focused on explicitly non-commercial uses, such as firewood gathering.[36] And the exception in Standard 2.b for cutting of old-growth trees when incidental to other management activities is described, consistent with the removal of the Tongass exception and the ending of the commercial logging program there, as applicable to activities like trail construction or recreational site development, not commercial timber harvest.[37]

In other parts of the DEIS, however, the agency explicitly leaves room for continued logging with a commercial purpose—like that ongoing under current policy—as authorized under the proposed amendment, apparently recharacterized as proactive stewardship logging or under the exceptions for logging incidental to other management activities, for de minimis use, or for previously authorized uses. For example, the DEIS states that the current commercial old-growth logging program would continue in the Tongass under Alternative 2:

> [I]n the limited instances where implementation of the [Southeast Alaska Sustainability Strategy] is not consistent with the definition of proactive stewardship in old-growth forests, the combined use of [Standards] 2.c.iii and 2.c.iv would allow for … small [old-growth] sales for local mills, music wood, and culturally significant uses like totem poles.[38]

The Draft Social, Economic, and Cultural Impacts Analysis Report also states that commercial old-growth logging would continue in the Tongass under Alternative 2:

> In Alaska, Alternative 2 effects are assumed to be the same as the no action alternative for the Tongass. Small and micro-old-growth sales and goods for services contracts would continue to occur according to Tongass Forest Plan direction and implementation of timber components of the Southeast Alaska Sustainability Strategy.[39]

Relatedly, Appendix C of the DEIS states that the current Tongass Land Management Plan, per the 2016 amendment, "directs a transition to primarily offering second-growth timber for commercial purposes, with an average of 5 MMBF of old-growth harvest per year by 2031,"[40] and thus is considered to already "functionally meet[] the intent of NOGA."[41]

Together, these provisions and statements in the DEIS present, at best, an inconsistent and confusing picture of the rules applicable to commercial logging, whether for a commercial purpose or by commercial means via a range of exceptions and allowances, of old growth on the Tongass, with some parts of the DEIS saying it would be precluded and other parts suggesting the current commercial program could continue. To eliminate this confusion and to be fully responsive to the input from the public and Tribes in Alaska seeking elimination of the Tongass exception, the Forest Service should—consistent with the recommendations we make above—1) make clear that any exception in Standard 2.b for logging incidental to other management activities does not authorize cutting of old-growth trees for commercial logging purposes (timber harvest); 2) eliminate the de minimis exception in Standard 2.c.iv or, at the very least, restrict it to firewood gathering by individuals; and 3) make clear that the exception for authorizations of use made prior to adoption of the amendment only includes such logging already subject to a timber sale contract at the time of the amendment.

The DEIS also suggests that some logging of old growth under the SASS might be consistent with the proactive stewardship provisions of the rule.[42] We are unaware of any circumstance in which the Forest

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[36] *Id.* at 105.
[37] *Id.* at 17.
[38] *Id.* at 33; *see also id.* at 121 ("Alternatives 2 and 4 allow for continued transition from old-growth to a primarily young-growth timber base with fewer effects to the timber industry and timber-related economic benefits.").
[39] USDA Forest Service, *Draft Social, Economic and Cultural Impacts Analysis Report for the DEIS for Amendments to LMPs to Address Old-Growth Forests Across the NFS* 36 (June 2024).
[40] *Id.* at 35.
[41] DEIS app. C, at C-2.
[42] DEIS at 33.

Service, or science, has suggested that logging of old growth is necessary for restoration or proactive stewardship now or in the foreseeable future on the Tongass. The Forest Service should clarify that logging of old growth on the Tongass is not justifiable under the proactive stewardship provision of the amendment.

Logging millions of board feet of old growth each year for commercial or any other purpose, if continued for just one decade, amounts to a significant loss of old-growth forests. Remaining old growth on the Tongass tends to have a very high defect rate of about 70% for timber production purposes. Young growth tends to have a 0.5-1% defect rate on average. Logging Tongass old growth to use in timber products is much more wasteful than using second or young growth. For the purposes of ecosystem services, however, Tongass old growth is highly effective, underscoring that logging old growth for use as a timber product is a poor choice and counter to the purposes of the amendment. The Forest Service's apparent belief that such continued logging would "foster the long-term resilience of old-growth forests and their contributions to ecological integrity"[43] is unsupportable scientifically. And it is completely inconsistent with even the insufficient protections the Forest Service proposes to erect for the rest of the country under the preferred alternative, where—ostensibly—logging for a commercial purpose in old-growth forests is barred.

We continue to support the exception for the use of old-growth trees for culturally significant purposes by Alaska Native peoples, and none of the changes we support here would affect the exception in the proposed rule for these uses of the Tongass.

b. Continued old growth logging will undermine the SASS.

The SASS sets out, in many respects, a positive direction for the Tongass. Under the SASS, the Forest Service has restored the Roadless Rule on the Tongass and begun to shift its resources to support and invest in forest restoration, recreation, and resilience throughout the region.[44] These changes and investments, and the partnerships the Forest Service has developed, support the region's primary economic drivers and bolster the resilience of the forest and the people and wildlife who depend on its habitat. The region's economic mainstays—the seafood and visitor industries—as well as the wild foods economy and subsistence ways-of-life of Alaska Native peoples and others,[45] are supported by old-growth ecosystems. We support these changes in how the Forest Service does business in Southeast Alaska.

However, tying the SASS to continued commercial logging of old growth including through "small and micro sales" will foster continued controversy and ultimately undermine the strategy. Successfully implementing the SASS can and must be done without any commercial old-growth logging. We believe this is a healthy evolution of the SASS that will lead to even broader support, less controversy, and faster project implementation. Removing the old-growth logging component of the SASS does not undermine the Forest Service's commitment to the strategy. Rather, it makes the Forest Service's commitment more durable and sustainable. Doing so will also lay the groundwork for a far more productive Tongass Land Management Plan revision process focused on popular and constructive goals such as forest restoration in degraded areas and new recreation opportunities while avoiding continued controversy over old-growth logging. Continuing commercial logging of old growth on the Tongass is simply unnecessary to successfully implement the SASS and threatens the long-term success of the strategy.

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[43] *Id.* at S-1.
[44] *Southeast Alaska Sustainability Strategy*, USDA Forest Service, https://www.fs.usda.gov/detail/r10/landmanagement/resourcemanagement/?cid=FSEPRD950023 (last visited Sept. 11, 2024) (outlining the components of the SASS).
[45] *See* U.S. Dep't of Agric., *USDA Southeast Alaska Sustainability Strategy Investment Recommendations, Appendix E: Regional Economic Overview*, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd1012381.pdf.

c. The NOGA should be a catalyst to transition local timber mills to second growth.

It has been more than ten years since Secretary Vilsack issued a directive to transition out of old growth logging on the Tongass.[46] A decade into that transition, there is no need to allow ongoing old growth logging for commercial or any other purposes. There is a ready and ample supply of second growth in lower conservation value areas with open road networks that can support existing local mills. Southeast Alaska's economy has changed in fundamental ways and no longer relies on old growth logging.

For the very few remaining small mills that still buy old-growth trees and have not yet chosen to upgrade their facilities to process smaller-diameter trees, the Draft Social, Economic, and Cultural Impacts Analysis Report details numerous Forest Service grant programs that can assist with their transition. This includes the Wood Products Infrastructure Assistance program that provides funding to support "facilities that purchase and process byproducts of ecosystem restoration projects. This includes applications to establish, reopen, retrofit, expand, or improve a sawmill or other wood-processing facility."[47] Retooling small mills to be able to process available second-growth, small-diameter trees would fully align with the NOGA's intent to maintain and protect old growth and the SASS's focus on restoration, resilience, and sustainable local economies.

The Forest Service should fully invest in these opportunities and solutions for these few mills in the Tongass rather than instituting a harmful, unnecessary, and archaic exception to continue to log old growth.

B. METHOD FOR IDENTIFYING OLD-GROWTH TREES[48]

The DEIS's analysis demonstrates a clear need for the agency to finalize a standard explicitly protecting the National Forest System's remaining old-growth trees as a core part of the agency's overall approach to old-growth forests. It discloses the unparalleled role large, old trees play in old-growth stands. It discloses the critical importance of such trees outside of old-growth stands. It recognizes that old-growth characteristics differ by ecosystem and species and that threats to old-growth forests differ in different regions and geographies, but that old-growth trees are an essential component across these differences. And it discloses operationalizable criteria to readily identify such trees. Taken together, these elements call for an old-growth tree-focused protective standard.

The DEIS discloses that old-growth trees both form the irreplaceable core of old-growth forests and play an irreplaceable role outside of old-growth stands. The analysis rightly acknowledges that "the presence of old trees, both within and outside of old-growth forests, represents a critical structural element that provides essential habitats for a diverse array of species and significantly contributes to carbon sequestration, biodiversity, and overall ecosystem resilience."[49] It notes that "[t]he rarity of old trees in comparison to historical conditions, as well as their keystone ecological functions and services, highlight their conservation value."[50] It acknowledges that, outside of old-growth forests, these trees "are often biological legacies resulting from intermediate disturbances [and] support particular ecosystem processes and biodiversity."[51] And, as described in more detail below, it identifies no ecological rationale for the agency to retain wide discretion to log old-growth trees. Quite the opposite: in multiple places, the analysis emphasizes that retaining large trees should be a core management goal, reflecting multiple peer-reviewed studies.[52]

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[46] U.S. Dep't of Agric., *Secretary's Memorandum 1044-009: Addressing Sustainable Forestry in Southeast Alaska* (July 2, 2013).

[47] USDA Forest Service, Draft Social, Economic and Cultural Impacts Analysis Report *for the DEIS for Amendments to LMPs to Address Old-Growth Forests Across the NFS* 32 (June 2024).

[48] The analysis in this section was developed in collaboration with Dr. Richard Birdsey.

[49] DEIAR at 24.

[50] *Id.*

[51] *Id.* at 25.

[52] Moomaw, W.R. et al. "Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good." *Frontiers in Forests and Global Change* (2019) 2(27). https://doi.org/10.3389/ffgc.2019.00027; Law, B.E. et

The document also highlights the irreplaceable socio-cultural role such trees play. The DEIS notes that "[o]ld trees are deeply rooted in human culture, carrying various cultural and aesthetic values and symbolic significance."[53] And it rightly emphasizes the critical need to protect these trees: "the conservation of old trees is *crucial* not only for maintaining biodiversity and ecosystem functions but also for preserving cultural heritage, traditional practices, and social values."[54]

And the document incorporates criteria for identifying these trees in the field. The DEIS rightly recognizes the need for operationalizable criteria to accompany the broader definitions of old growth. It states that "[t]he simplification of old-growth definitions into criteria is necessary to provide both unit managers and the public a shared understanding of exactly which stands should be managed as old-growth forest."[55] Following this passage, the analysis details the process it followed to develop the definitions and criteria used in its national inventory of mature and old-growth forests.[56] Concluding, the analysis states that "[t]he same definitions, criteria, and methods used in the published national inventory form the basis for analysis of the proposed action and alternatives in this EIS."[57]

The regional old growth "working definitions" used in the national inventory each include explicit criteria for identifying mature and old-growth forests by region and forest types, including supporting—or readily derivable—DBH criteria for large trees associated with old-growth forests in many cases. Taken as a whole, the range of criteria incorporated into the definitions can complicate the application of consistent rules and introduce broad discretion for managers that undermine protective outcomes. And the DBH criteria themselves are not perfect—they often, for example, fail to consistently classify forest types and tree species that cross regional boundaries. Notwithstanding these concerns, however, the DBH criteria provide a solid foundation for defining, identifying, and protecting old-growth trees.

Using these built-in DBH criteria to identify old-growth trees for executing a protective standard has several benefits. From a land manager's perspective, it is straightforward to work with a minimum diameter threshold above which trees would not be cut. Further, as noted, the Forest Service has already defined DBH criteria for many regions and forest types. And this approach could readily be expanded to cover all regions and forest types using Forest Inventory and Analysis ("FIA") data, as demonstrated in previous studies.[58] An example of a set of diameter limits based on the Forest Service inventory of mature and old-growth forests, expanded to include all regions and major forest types, is shown in Table 1.

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al. "Land use strategies to mitigate climate change in carbon dense temperate forests." *Proceedings of the National Academy of Sciences of the United States of America* (2018) 115(14): 3663–3668. https://doi.org/10.1073/pnas.1720064115; Law, B.E. et al. "Creating strategic reserves to protect forest carbon and reduce biodiversity losses in the United States." *Land* (2022) 11(721). https://doi.org/10.3390/land11050721; Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274.

[53] DEIAR at 25.

[54] *Id.* (emphasis added).

[55] *Id.* at 6.

[56] *Id.* at 6–10. USDA Forest Service and DOI Bureau of Land Management, *Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and Bureau of Land Management in Fulfillment of Section 2(b) of Executive Order No. 14072* (revised Apr. 2024) ("Mature and Old Growth Inventory").

[57] DEIAR at 10.

[58] Barnett K. et al. "Classifying, inventorying, and mapping mature and old-growth forests in the United States." *Frontiers in Forests and Global Change* (2023) 5:1070372. https://doi.org/10.3389/ffgc.2022.1070372; Birdsey, R.A. et al. "Assessing carbon stocks and accumulation potential of mature forests and larger trees in U.S. federal lands." *Frontiers in Forests and Global Change* (2023) 5:1074508. https://doi.org/10.3389/ffgc.2022.1074508; Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274.

Table 1: Examples of diameter limits for old growth derived from the Mature and Old Growth Inventory.[59]

Region and forest type	Diameter limit
R1-North	
200 Douglas-fir group	21
220 Ponderosa pine group	21
260 Fir / spruce / mountain hemlock group	21
280 Lodgepole pine group	13
R2-Rockies	
220 Ponderosa pine group	16
260 Fir / spruce / mountain hemlock group	16
900 Aspen / birch group	14
R3-Southwest	
180 Pinyon / juniper group	12
220 Ponderosa pine group	18
R4-Intermountain	
200 Douglas-fir group	24
260 Fir / spruce / mountain hemlock group	20
280 Lodgepole pine group	10
R5 Pacific SW	
220 Ponderosa pine group	21
260 Fir / spruce / mountain hemlock group	30
280 Lodgepole pine group	36
370 California mixed conifer group	39
920 Western oak group	10
R6-Pacific Northwest	
200 Douglas-fir group	30
260 Fir / spruce / mountain hemlock group	30
300 Hemlock / Sitka spruce group	39

[59] The figures in Table 1 are illustrative. They are not meant to represent all forest types or their variability among or within regions.

R8-South	
160 Loblolly / shortleaf pine group	16
400 Oak / pine group	20
500 Oak / hickory group	14
800 Maple / beech / birch group	16
R9-East	
120 Spruce / fir group	12
500 Oak / hickory group	16
800 Maple / beech / birch group	16

And to the extent that these criteria need to be further refined, the agency possesses ample data to easily do so. The agency could extrapolate estimates for missing forest types from adjacent regions or similar forest types. Alternatively, the agency could use a diameter distribution approach to specify old-growth tree DBH criteria: use existing literature or FIA stand condition variables to determine a minimum age for old growth in a given forest type,[60] use FIA to estimate the biomass carbon stock by DBH class associated with the selected age class, and use a calculated point—such as the median—within that distribution as a criterion for identifying large trees in the given forest type.[61]

This approach is consistent nationwide, easy to apply, and related to a key characteristic for classifying forests as old growth. And, focusing on large trees has many benefits as noted earlier: fire resistance, resilience after disturbance, endangered species habitat, and addressing public concerns about preserving old-growth trees. Apart from old-growth forests, large trees in forests that are not classified as old growth still have these benefits, which may even be greater because of their rarity relative to more populous smaller trees.

III. The Case for Retaining Old-Growth Trees and Infrequent-Fire Old-Growth Forests

Neither the DEIS nor the broader scientific literature supports retaining discretion to log old-growth trees or infrequent-fire old-growth stands, much less to subject them to commercial exchange. They provide myriad benefits when they are left unlogged and are in severe deficit nationwide. Logging them is an ineffective, inefficient, and counterproductive approach to managing them.

Retaining discretion to log old-growth trees has no scientific justification. These trees are not significant contributors to the risks USFS associates with various disturbances. They often help mitigate these risks, in addition to providing many other benefits. They are the cornerstone of old-growth forests. And, as the DEIS discloses, these trees are not drivers of economic activity. Logging them eliminates their benefits for little—if any—gain.

Similarly, as explained below, infrequent-fire old-growth stands do not need intervention. Intervention in *frequent*-fire forest types historically subject to high grading, grazing, and fire suppression can sometimes be

[60] Recent literature provides guides on how to select such ages from FIA. *See, e.g.*, Woodall, C.W. et al. "Classifying mature federal forests in the United States: The forest inventory growth stage system." *Forest Ecology and Management* (2023) 546:121361. https://doi.org/10.1016/j.foreco.2023.121361; Stanke, H. et al. "rFIA: An R package for estimation of forest attributes with the US Forest Inventory and Analysis database." *Ecology Modelling and Software* (2020) 127:104664. https://doi.org/10.1016/j.envsoft.2020.104664.

[61] This diameter distribution approach is outlined in more detail in Birdsey, R.A. et al. "Assessing carbon stocks and accumulation potential of mature forests and larger trees in U.S. federal lands." *Frontiers in Forests and Global Change* (2023) 5:1074508. https://doi.org/10.3389/ffgc.2022.1074508. That paper focuses on mature forests, but the methodology is readily transferable to different age classes.

justified in certain circumstances. But *infrequent*-fire old-growth forests generally retain intact ecosystem functions, processes, and structures.[62] And the DEIS provides little evidence that the potential future effects of climate change justify intervention. Among other things, the efficacy of active management in these settings to guard against those effects is highly speculative. But the deleterious effects of such management on carbon storage, biodiversity, watershed integrity, and other forest functions are well established.

There is no need to log these trees and stands, and absolutely no justification for subjecting them to commercial exchange.

A. Logging old-growth trees or infrequent-fire old-growth stands is unnecessary and counterproductive.

i. Logging old-growth trees and infrequent-fire old-growth stands undermines efforts to address climate change.

Appendix A provides a detailed analysis by Dr. David Mildrexler on the clear contradiction between broad discretion to log old growth and achieving climate goals. In particular, the analysis comprehensively demonstrates that old growth is critical to the fight against climate change**.** Among other things, logging old-growth trees or infrequent-fire old-growth forests runs counter to ecological and climate goals. A review of the scientific literature finds no support for logging these forest elements. Rather, the research highlights broad consensus around targeted restoration needs in frequent-fire old-growth forests focused on restoring the process of fire, and removing young, small trees where needed to support such efforts. But, notwithstanding the clear direction of the literature, the DEIS attempts to leverage climate change impacts to retain unjustifiably broad discretion to log old growth, threatening greater emissions during a rapidly closing window of time in which we need to reduce emissions to meet climate goals.

ii. The DEIS does not provide support for logging old-growth trees or infrequent-fire old-growth stands to manage natural disturbances.

The DEIS suggests that natural disturbances such as fire, insects, and drought are increasing threats to old growth and that proactive stewardship—including extensive discretion to log—is the way to address those threats. This section looks at the degree to which these and other disturbances are threats to old growth and, if so, what the scientific literature shows in terms of the ability of logging to alleviate those threats.

1. Fire

a. Old-growth trees are generally more fire-resistant.

Old-growth trees are not the primary contributors to wildfires. For a variety of reasons, old trees tend to be well positioned to survive the disturbance-enhancing effects of climate change, including wildfires—as the DEIS itself acknowledges.[63] Key adaptations include increasing bark thickness, shedding lower branches, increasing height, and developing more open crowns.[64] Together, adaptations like these make it difficult for fire to ignite tree boles or climb into flammable canopies in larger/older trees, particularly in western fire-adapted forest types.[65]

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[62] Franklin, J. F. and K. N. Johnson. "A restoration framework for federal forests in the Pacific Northwest." *Journal of Forestry* (2012) 110(8): 429–439. https://doi.org/10.5849/jof.10-006.

[63] DEIAR at 24.

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

[65] Thompson, J.R. and T.A. Spies. "Vegetation and weather explain variation in crown damage within a large mixed-severity wildfire." *Forest Ecology and Management* (2009) 258: 1684–1694. https://doi.org/10.1016/j.foreco.2009.07.031.

Among western trees, fire resistance is generally more developed in older pines, certain cedars, Douglas-fir and western larch. Older giant Sequoia are significantly fire-resistant.[66] Even white, grand, and other true fir species—considered fire intolerants—often survive fires if they are older and have developed thicker bark and higher crowns.[67] And the ponderosa pine found throughout western forests is the quintessential fire-adapted tree because of thick bark,[68] elevated canopies and few low branches,[69] fast-flammable leaf litter,[70] and capacity to regrow after high crown scorch (among other things).[71] Cone and seed production in ponderosa pine are also much more robust in larger trees.[72]

b. Old-growth trees and stands contribute to an ecosystem's ability to resist and recover from wildfire.

Old-growth stands—which are primarily characterized by the presence of old-growth trees—can act as refugia for imperiled species during wildfire events.[73] One study demonstrated that old-growth forests have cooler microclimates that can better provide refugia for temperature-sensitive species when compared to single species, even-aged plantation sites:

> Vegetation characteristics associated with older forest stands appeared to confer a strong, thermally insulating effect. Older forests with tall canopies, high biomass, and vertical complexity provided cooler microclimates compared with simplified stands.
>
> …
>
> This effect was potentially attributable to large differences in biomass between forest types, rather than canopy cover, as we observed less variation in canopy cover between old-growth sites and plantation sites.
>
> …
>
> In jurisdictions where biodiversity maintenance is the goal, conservation and restoration of structures associated with old-growth forests are more likely to sustain favorable microclimates and to reduce climate change impacts on temperature-sensitive species.[74]

Taken together, the old-growth biomass—including the large trees—provided cooler conditions than the intensively managed plantation sites. Another study demonstrates how those cooler conditions moderated wildfire effects on northern spotted owl habitat:

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[66] Habeck, R. J. "Sequoiadendron giganteum." In: "Fire Effects Information System, [Online]." USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (1992). https://www.fs.usda.gov/database/feis/plants/tree/seqgig/all.html.

[67] Zouhar, Kris. "Abies concolor. In: Fire Effects Information System, [Online]." USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2001). Available: https://www.fs.usda.gov/database/feis/plants/tree/abicon/all.html.

[68] Stevens, J., et al. "Biogeography of fire regimes in western U.S. conifer forests: A trait-based approach." *Global Ecology and Biogeography* (2020) 29(5). https://doi.org/10.1111/geb.13079.

[69] *Id.*

[70] *Id.*

[71] Harrington, M.G. "Predicting Pinus ponderosa mortality from dormant season and growing-season fire injury." *International Journal of Wildland Fire* (1993) 3: 65–72. https://doi.org/10.1071/WF9930065.

[72] Krannitz, P.G. and T.E. Duralia. "Cone and seed production in Pinus ponderosa: a review." *Western North American Naturalist* (2004) 64(2): 208–218; Baker, W. L. (2021). Restoration of forest resilience to fire from old trees is possible across a large Colorado dry-forest landscape by 2060, but only under the Paris 1.5℃ goal. Global Change Biology, 27, 4074–4095. https://doi.org/10.1111/gcb.15714.

[73] Lesmeister, D.B. et al. "Mixed-severity wildfire and habitat of an old-forest obligate." *Ecosphere* (2019) 10(4): e02696. https://doi.org/10.1002/ecs2.2696. *See also* DEIAR at 24–26.

[74] Frey, S.J.K. et al. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." *Science Advances* (2016) 2:e1501392. https://doi.org/10.1126/sciadv.1501392.

> Under most wildfire conditions, the microclimate of interior patches of suitable nesting forests likely mitigated fire severity and thus functioned as fire refugia (i.e., burning at lower severity than the surrounding landscape). With changing climate, the future of interior forest as fire refugia is unknown, but trends suggest older forests can dampen the effect of increased wildfire activity and be an important component of landscapes with fire resiliency.[75]

Other studies also show old-growth stands typically have higher moisture content, resulting in less proportionate biomass that is available to burn. This moisture, combined with larger basal area, results in stands having increased shade and humidity, as well as lower temperatures and wind speeds, improving overall fire resistance.[76]

c. Fire is a natural and necessary part of many forest ecosystems.

The DEIS does not sufficiently acknowledge the ecological benefits of wildfire, which is a natural process that most native plant and wildlife species are adapted to, and that there is still a deficit of natural fire processes across many forested landscapes.[77] Some forest types—like lodgepole pine—evolved with stand-replacing wildfire, which is necessary for regeneration.[78] More broadly, (especially in mixed conifer forests) wildfires help moderate fuel loads,[79] create a mosaic of habitat types that many species rely on for various essential behaviors,[80] and regulate nutrient cycling.[81] Wildfires can also deliver large downed wood and pulses of sediment needed by aquatic ecosystems (as compared to heavily impacted watersheds).[82]

d. Cutting old-growth trees is not necessary—and often counterproductive—to address wildfire.

Cutting old-growth trees is an ineffective, inefficient, and counterproductive approach to managing the risks associated with fire. The DEIS fails to provide compelling evidence that it is necessary to cut old-growth trees and, in fact, points in the opposite direction.[83] The primary discussion of fire as a driver/stressor in the analysis focuses on stand- and forest-level trends.[84] The discussion of vegetation management to control fire is largely focused on the importance of cultural burning and prescribed fire.[85] And to the extent the analysis

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[75] Lesmeister, D.B., et al. "Northern spotted owl nesting forests as fire refugia: a 30-year synthesis of large wildfires." *Fire Ecology* (2021) 17:32. https://doi.org/10.1186/s42408-021-00118-z.

[76] Countryman, C.M. "Old-growth conversion also converts the fire climate." USDA Forest Service Fire Control Notes (1956) 17(4): 15–19. https://www.fs.usda.gov/sites/default/files/fire-management-today/FSPubs-FMT-79%283%29.pdf (last accessed July 24, 2024); Kitzberger, T., et al. "Decreases in Fire Spread Probability with Forest Age Promotes Alternative Community States, Reduced Resilience to Climate Variability and Large Fire Regime Shifts." *Ecosystems* (2012) 15: 97–112. https://doi.org/10.1007/s10021-011-9494-y; Frey, S.J.K. et al. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." Science Advances (2016) 2(4): e1501392. https://doi.org/10.1126/sciadv/1501392; Agee, J.K. and C.N. Skinner. "Basic principles of forest fuel reduction treatments." *Forest Ecology and Management* (2005) 211: 83–96. https://doi.org/10.1016/j.foreco.2005.01.034.

[77] Marlon, J.R., et al. "Long-term perspective on wildfires in the western USA." *PNAS* (2012) 109(9): E535–E543. https://doi.org/10.1073/pnas.1112839109.

[78] *See, e.g.*, U.S. Forest Serv., *Regional Old Growth Summary* 2 (June 2024). https://usfs-public.app.box.com/v/PinyonPublic/file/1566818271693.

[79] Miller, C. "Wildland Fire Use: A Wilderness Perspective on Fuel Management." USDA Forest Service Proceedings, RMRS-P-29 (2003). http://winapps.umt.edu/winapps/media2/leopold/pubs/480.pdf.

[80] *See, e.g.,* Clark, D.A. "Demography and Habitat Selection of Northern Spotted Owls in Post-Fire Landscapes of Southwestern Oregon." Oregon State University M.S. Thesis (2007). Robert Anthony, Advisor. https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/5m60qt980.

[81] McLauchlan, K.K. et al. "Fire as a fundamental ecological process: Research advances and frontiers." *Journal of Ecology* (2020) 108(5): 2047–2069. https://doi.org/10.1111/1365-2745.13403.

[82] Rhodes, J.J. and W.L. Baker. "Fire Probability, Fuel Treatment Effectiveness and Ecological Tradeoffs in Western U.S. Public Forests." *The Open Forest Science Journal* (2008) 1: 1–7. https://doi.org/10.2174/1874398600801010001.

[83] DEIAR at 40–41.

[84] *Id.* at 30–33.

[85] *Id.* at 39–42.

details tree cutting in a fire context, its focus is on younger trees.[86] Indeed, the analysis repeatedly notes the critical importance of retaining old-growth trees as a goal of management, in part for their role in moderating the effects of fire.[87]

The broader scientific literature reinforces this conclusion. The rate of forest fire spread is typically dictated by the quantity of highly flammable foliage and branches in smaller (drier) trees and shrubs—not the presence of old trees.[88] Moreover, the relationship between vegetative conditions and fire activity is complex, and even the presence of such flammable foliage, does not necessarily dictate the prevalence of wildfire or its intensity and severity:

> Plant communities create dynamic moisture and mass characteristics, as well as spacing and distribution of vegetative components, including live and dead plant material and organic soil formation (Carpenter et al. 2021, Hiers et al. 2007, Kauf et al. 2018). These determine if or when vegetation hinders or contributes to fire activity.[89]

Further, research demonstrates that large tree removal is an ineffective approach to reducing wildfire risks and in some cases can increase fire risk. Logging that opens old-growth forest stands or decreases crown densities may increase air temperatures, increase surface winds, and allow surface fuels to become drier, elevating fire risk.[90] Other research supports these findings, particularly where old-growth forests exhibit mesic conditions:

> Fuel reduction treatments are not appropriate for all conditions or forest types (DellaSala et al. 2004, Reinhardt et al. 2008, Naficy et al. 2016). In some mesic forests, for instance, mechanical treatments may increase the risk of fire by increasing sunlight exposure to the forest floor, drying surface fuels, promoting understory growth, and increasing wind speeds that leave residual trees vulnerable to wind throw (Zald and Dunn 2018, Hanan et al. 2020).
>
> …
>
> In other forest types such as subalpine, subboreal, and boreal forests, low crown base heights, thin bark, and heavy duff and litter loads make trees vulnerable to fire at any intensity (Agee 1996, Stevens et al 2020). Fire regimes in these forests, along with lodgepole pine, are dominated by moderate- and high-severity fires, and applications of forest thinning and prescribed underburning are generally inappropriate.[91]

Additional research reinforces the finding that logging old-growth stands, especially old-growth trees, could exacerbate wildfire-caused tree mortality:

> Furthermore, there are instances when removing small to moderate portions of vegetation can do the opposite of its intention; opening the canopy and midstory space can increase the penetration of solar radiation and entrain more winds, including heavy wind gusts. Both can promote moisture loss within and beneath the canopy, including drying of groundcover plants and the litter layer, creating a

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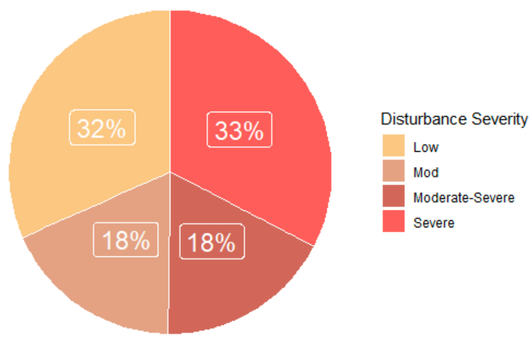
[86] *Id.*
[87] *See*, *e.g.*, *id.* 40–41.
[88] Rothermel, R.C. "How to predict the spread and intensity of forest and range fires." USDA Forest Service Gen. Tech. Rep. INT-GTR-143. Intermountain Forest and Range Experiment Station, Ogden, UT (1983). https://doi.org/10.2737/INT-GTR-143.
[89] Loudermilk, E.L., et al. "Vegetation's influence on fire behavior goes beyond just being fuel." Fire Ecology (2022) 18: 9. https://doi.org/10.1186/s42408-022-00132-9.
[90] Pimont, F. et al. "Validation of FIRETEC wind-flows over a canopy and a fuel-break." *International Journal of Wildland Fire* (2009) 18(7): 775–790. https://doi.org/10.1071/WF07130; Parsons, R.A. et al. "Modeling thinning effects on fire behavior with STANDFIRE." *Annals of Forest Science* (2018) 75:7. https://doi.org/10.1007/s13595-017-0686-2.
[91] Prichard, S.J., et al. "Adapting western North American forests to climate change and wildfires: 10 common questions." *Ecological Applications* (2021) 31(8):28–58. https://doi.org/10.1002/eap.2433.

more favorable combustion environment for fire ignition and spread (Banerjee 2020; Banerjee et al. 2020; Russell et al. 2018; Marshall et al. 2020; Matthews et al. 2012).[92]

e. Cutting infrequent-fire old-growth stands is not necessary—and often counterproductive—to address wildfire.

The DEIS does not provide compelling evidence of a need to cut infrequent-fire old-growth stands to prevent fire. (We are not proposing that the NOGA prohibit cutting younger trees in *frequent-fire* old-growth forests.) The agency asserts wildfire is the leading threat to old-growth forests,[93] and proceeds to provide analysis disclosing the range of fire severity within fire-disturbed old-growth forests, including the following chart:[94]



But the agency fails to disclose how these disturbance severities compare with the Forest Service's own Fire Regime Groups ("FRG") under its LANDFIRE planning tool that delineates stand replacement fire and fire return intervals displayed below in Table 2.

[92] Loudermilk, E.L., et al. "Vegetation's influence on fire behavior goes beyond just being fuel." Fire Ecology (2022) 18: 9. https://doi.org/10.1186/s42408-022-00132-9.
[93] DEIS at S-4.
[94] *Id.* at 71. *See also* DEIAR at 30–31.

Table 2. Fire regime group labels and definitions:[95]

Fire regime group label	Definition
I–A	Percentage of replacement fire less than 66.7%, fire return interval 0–5 years
I–B	Percentage of replacement fire less than 66.7%, fire return interval 6–15 years
I–C	Percentage of replacement fire less than 66.7%, fire return interval 16–35 years
II–A	Percentage of replacement fire greater than 66.7%, fire return interval 0–5 years
II–B	Percentage of replacement fire greater than 66.7%, fire return interval 6–15 years
II–C	Percentage of replacement fire greater than 66.7%, fire return interval 16–35 years
III–A	Percentage of replacement fire less than 80%, fire return interval 36–100 years
III–B	Percentage of replacement fire less than 66.7%, fire return interval 101–200 years
IV–A	Percentage of replacement fire greater than 80%, fire return interval 36–100 years
IV–B	Percentage of replacement fire greater than 66.7%, fire return interval 101–200 years
V–A	Any severity, fire return interval 201–500 years
V–B	Any severity, fire return interval 501 or more years

The Forest Service did not correlate the disturbance severities with the FRGs to demonstrate the extent to which the areas captured by the "moderate-severe" and "severe" percentages in fire-disturbed old-growth stands occurred outside the typical LANDFIRE stand replacement percentages or its return intervals. For example, the Forest Service fails to demonstrate the extent to which the proportion of the 33% of fires it allocates to "Severe" were outside the normal fire return intervals of the forests in which they occurred. By failing to do so, the agency does not sufficiently establish the magnitude of the threat across those areas, particularly in the infrequent-fire old-growth stands of FRG III-V that typically experience more severe fire when they do burn, but over longer return intervals.[96]

Fortunately, research fills in the DEIS's analytic lacuna, indicating that logging to manage wildfire in infrequent-fire old-growth forests is unnecessary and counterproductive. As described above, infrequent-fire old-growth stands often have naturally developed characteristics that make them resilient to wildfire—and even serve as refugia during fire for other species.[97] Logging in such stands is unlikely to alter fire behavior, in large part because fires in these forests are often wind driven, which minimizes the influence of forest management.[98] Indeed, logging in these forests can exacerbate fire risk and other stressors (e.g., invasive species).[99] These stands are the rare survivors of recent centuries of intensive industrial logging, and they

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[95] La Puma, I.P., ed., "LANDFIRE technical documentation." *U.S. Geological Survey* Open-File Report 2023–1045 (2023). https://doi.org/10.3133/ofr20231045.
[96] DEIAR at 4 ("Historical disturbance regimes are derived from this information, where areas with historic fire return intervals that are 35 years or less are described as 'Frequent' (i.e., FRG I and II) and 'Not Frequent' for fire return intervals greater than 35 years (i.e., FRG III, IV, and V).").
[97] *See supra* III.A.ii.1.b.
[98] Reilly, M.J. et al. "Chapter 10: Fire Ecology and Management in Pacific Northwest Forests." In: "Fire Ecology and Management: Past, Present, and Future of US Forested Ecosystems" *Springer* (2021) 393–435. Edited by: C.H. Greenberg and B. Collins. https://doi.org/10.1007/978-3-030-73267-7_10; Reilly, M.J. et al. "Cascadia Burning: The historic, but not historically unprecedented, 2020 wildfires in the Pacific Northwest, USA." (2022) *Ecosphere* 13(6): e4070. https://doi.org/10.1002/ecs2.4070.
[99] Reilly, M.J. et al. "Chapter 10: Fire Ecology and Management in Pacific Northwest Forests." In: "Fire Ecology and Management: Past, Present, and Future of US Forested Ecosystems" *Springer* (2021) 393–435. Edited by: C.H. Greenberg and B. Collins. https://doi.org/10.1007/978-3-030-73267-7_10.

should be protected from future logging, which has highly uncertain certain benefits and is always accompanied by harmful ecological impacts.

More broadly, given that fuel treatments' periods of potential effectiveness tend to be relatively short in duration (often ten years or less),[100] the Forest Service needs to also consider the monetary costs, budget implications, and funding mechanisms for repeated maintenance of treatments. And for the same reason, the agency needs to consider the ecological and societal costs of repeated treatments, including degradation and removal of old forest habitat values, lost and delayed carbon storage, and increased carbon emissions.

2. Drought

a. Drought as a forest stressor

Old-growth trees are not drivers of the risks USFS associates with drought, nor are they especially susceptible to drought-related mortality. The DEIS discloses that the effects of drought—such as reduced streamflow and water availability—can increase stand stress and make forests more susceptible to secondary disturbances, such as wildfire or insect epidemics.[101] While old-growth trees feel the effects of drought stress (along with every other organism operating under drought conditions), they have generally developed mechanisms that both allow them to better cope with drought and confer resilience benefits to the entire forest. As discussed below, logging these trees eliminates these benefits and provides little in the way of increased forest resilience.

Drought's impacts are dispersed and variable, determined by tree species, size, region, and age class.[102] Growth rate is a common factor considered when determining drought impacts on a tree or stand. While an incomplete metric for determining resilience, larger, taller trees do typically experience a more significant decrease in growth rate during a drought as compared to smaller trees; however, the severity of this phenomenon varies by age class. A study of over 20,000 canopy-dominant trees, spanning 5 continents, showed that younger trees generally experience a greater slowing of growth rate under drought conditions compared to old-growth trees.[103] These results were consistent across all biomes except for desert and tropical landscapes. The average reduction in growth rate in temperate forests, for example, was 8% (angiosperms) and 3-4% (gymnosperms) higher in the youngest canopy-dominant cohort, compared to the oldest cohort.[104]

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[100] Omi, P.N. and E.J. Martinson, "Effectiveness of Fuel Treatments for Mitigating Wildfire Severity: A Manager-Focused Review and Synthesis." JFSP Research Project Reports (2010) 58. https://www.firescience.gov/JFSP_fuels_treatment.cfm; Campbell, J.L. et al. "Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions?" *Frontiers in Ecology and the Environment* (2012) 10(2): 83–90. https://doi.org/10.1890/110057; Barnett, K. et al. "Beyond Fuel Treatment Effectiveness: Characterizing Interactions between Fire and Treatments in the US. Forests." *Forests* (2016) 7: 237. https://doi.org/10.3390/f7100237; Rhodes, J.J. and W.L. Baker. "Fire Probability, Fuel Treatment Effectiveness and Ecological Tradeoffs in Western U.S. Public Forests." *The Open Forest Science Journal* (2008) 1: 1–7. http://dx.doi.org/10.2174/1874398600801010001.

[101] DEIAR 38; Vose, J.M. et al. "Can forest watershed management mitigate climate change effects on water resources?" In: "Revisiting Experimental Catchment Studies in Forest Hydrology. Proceedings of a workshop held during the XXV International Union of Geodesy and Geophysics." *International Association of Hydrological Sciences Publication Publ.* (2011) 12–25. Edited by A. Webb, et al. https://research.fs.usda.gov/treesearch/41261; Stephenson, N.L. et al. "Which trees die during drought? The key role of insect host-tree selection." Journal of Ecology (2019) 107(5): 2383–2401. https://doi.org/10.1111/1365-2745.13176.

[102] Au, T.F. et al. "Younger trees in the upper canopy are more sensitive but also more resilient to drought." *Nature Climate Change* (2022) 12: 1168–1174. https://doi.org/10.1038/s41558-022-01528-w; Stephenson, N.L. et al. "Which trees die during drought? The key role of insect host-tree selection." Journal of Ecology (2019) 107(5): 2383–2401. https://doi.org/10.1111/1365-2745.13176.

[103] *Id.*

[104] *Id.*

b. Old-growth trees confer drought resilience to entire stands.

Old-growth trees also support the health and resilience of the rest of the forest in face of drought conditions. Canopy-dominant trees create cooler, shady microclimates which help retain moisture in the soils and understory.[105] They also tend to use water more efficiently, allowing for greater water availability.[106] Deep rooting networks also help increase the water storage capacity of the forest by allowing trees to access groundwater, supporting porous soil structures, and allowing for greater water infiltration from the surface to deeper groundwater stores.[107] This infiltration reduces stormwater runoff, increases the water storage capacity of the system, and helps buffer against flooding and drought.[108] Even if they experience slightly reduced growth rates, these trees provide numerous supportive benefits—above and below ground—to the other forest system components during times of drought.

And these benefits compound. The DEIS acknowledges the role old-growth forests play in sustaining ample, clean water:

> [T]ree root channels created by trees can serve as flow paths for water infiltration, enhancing soil permeability and promoting groundwater recharge. Old-growth forests can also intercept and transpire precipitation, influence snowmelt timing, and modulate the quantity and timing of stream flow. In certain forest types such as coast redwood and pine forests from central California and Oregon, fog drip can be a significant contributor to soil moisture (Dawson, 1998, Ingwersen 1985). Perry and Jones (2016) found daily streamflow from basins within young plantations of Douglas-fir was 50 percent lower than streamflow originating from reference basins with older forests.[109]

Given the emphasis on climate change within the DEIS, it bears underscoring that the climatic benefits of the relative drought resilience of old-growth trees are further multiplied by the longer carbon residence time and greater carbon storage capacity of older trees.[110]

c. Logging old-growth trees is an ineffective drought management strategy.

Logging old-growth trees, on the other hand, destabilizes these benefits with little gain. As previously discussed, maintaining large old-growth trees on the landscape is fundamental for drought resilience. Where thinning removes older, canopy-dominant trees, microclimatic buffering is reduced.[111] This allows surface temperatures to increase, increasing the drought sensitivity of the forest and creating warmer, drier conditions.[112] If soils are compacted in the thinning process, which includes road construction and use of heavy machinery, the near-term water storage capacity of the forest is also reduced. Altered conditions like these can make it more difficult for the remaining trees to return to pre-drought growth rates, reducing forest resilience overall.[113]

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[105] *Id.*;Frey, S.J.K. et al. "Spatial models reveal the microclimatic buffering capacity of old-growth forests." *Science Advances* (2016) 2:e1501392. https://doi.org/10.1126/sciadv.1501392.

[106] Farinacci, M.D. et al. "Carbon-water tradeoffs in old-growth and young forests of the Pacific Northwest." *AGU Advances* (2024) 5(4): e2024AV001188. https://doi.org/10.1029/2024AV001188.

[107] Jones, J. et al. "Forest restoration and hydrology." *Forest Ecology and Management* (2022) 520: 120342. https://doi.org/10.1016/j.foreco.2022.120342.

[108] *Id.*

[109] DEIAR at 12.

[110] *Id.*

[111] Au, T.F. et al. "Younger trees in the upper canopy are more sensitive but also more resilient to drought." *Nature Climate Change* (2022). 12(12), 1168–1174. https://doi.org/10.1038/s41558-022-01528-w.

[112] *Id.*

[113] *Id.*

Active management to enhance drought resilience is most effective in places where water is the primary growth limiting factor,[114] particularly in dry, frequent-fire forest types. In such forests, some understory management of young trees may be appropriate to alleviate competitive stress in drought conditions. But, given the uncertainty around drought impacts and the well-established stress associated with thinning, such management should be pursued sparingly. And it should never target old-growth trees.

In older, infrequent-fire forest types, drought impacts pose a lower risk to the system, making active management for drought resilience particularly unjustifiable. This is compounded by the negative ecological impacts associated with thinning, which include upsetting soil carbon and structure, polluting nearby waterways, and reducing live forest carbon stocks.

3. Insects

Native insects help create healthy soil, recycle nutrients, pollinate flowers, and control population growth of other insects. They are ubiquitous disturbance agents cultivating decadence, resetting successional development, and creating important wildlife habitat. Old-growth trees are not a driver of insect activity, and as an age class, old growth is not particularly susceptible to mortality from insects.[115] Rather, old-growth trees and forests possess attributes that confer resilience to insect activity, including providing habitat for diverse insectivorous predator species.[116] Logging old-growth trees will not reduce insect disturbance impacts and logging infrequent-fire old-growth stands is an ineffective way to address insect-related issues.

a. Old-growth trees and moist old-growth forests are well equipped to handle insect-related disturbances.

Old-growth trees and infrequent-fire old-growth forests generally possess a variety of robust mechanisms to protect against insects. The primary defenses most trees have to insect damage include producing pitch (oleoresin flooding),[117] hosting a diversity of insectivores, less penetrable bark, and natural heterogeneity[118]—all characteristics that are typically enhanced in old-growth stands. Insects may overcome these defenses if enough of them are recruited to the target tree to colonize.[119] Often, an insect outbreak begins with

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[114] Sohn, J.A. et al. "Potential of forest thinning to mitigate drought stress: A meta-analysis." *Forest Ecology and Management* (2016) 380: 261–273. https://doi.org/10.1016/j.foreco.2016.07.046.

[115] Schowalter T. "Arthropod Diversity and Functional Importance in Old-Growth Forests of North America." *Forests* (2017) 8(4):97. https://doi.org/10.3390/f8040097; Lynch, A.M. and T.W. Swetnam. "Old-growth Mixed Conifer and Western Spruce Budworm in the Southern Rocky Mountains." In: "Old-Growth Forests in the Southwest and Rocky Mountain Regions: Proceedings of a Workshop." *USDA Forest Service* Gen. Tech. Report RM-213. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO (1992) 66–80. Edited by M.R. Kaufman, W.H. Moir, R.L. Bassett. https://doi.org/10.2737/RM-GTR-213.

[116] Schowalter T. "Arthropod Diversity and Functional Importance in Old-Growth Forests of North America." *Forests* (2017) 8(4):97. https://doi.org/10.3390/f8040097; Venier, L.A. and Holmes, S.B. "A review of the interaction between forest birds and eastern spruce budworm." *Environmental Reviews* (2010) 18, 191–207; Betts, M.G. et al. "Old-growth forests buffer climate-sensitive bird populations from warming." *Diversity and Distributions* (2017) 24(4): 439–447. https://doi.org/10.1111/ddi.12688.

[117] Fettig, C.J. et al. "The Effectiveness of Vegetation Management Practices for Prevention and Control of Bark Beetle Infestations in Coniferous Forests of the Western and Southern United States." *Forest Ecology Management* (2007) 238(1): 24–53. https://doi.org/10.1016/j.foreco.2006.10.011; Krokene, P. "Conifer Defense and Resistance to Bark Beetles." In: "Bark Beetles: Biology and Ecology of Native and Invasive Species." *Elsevier* (2015) 177–207. Edited by F.E. Vega and R.W. Hofstetter. http://dx.doi.org/10.1016/B978-0-12-417156-5.00005-8.

[118] Schowalter T. "Arthropod Diversity and Functional Importance in Old-Growth Forests of North America." Forests (2017) 8(4):97. https://doi.org/10.3390/f8040097; Valor, T. et al. "Resin ducts and bark thickness influence pine resistance to bark beetles after prescribed fire." *Forest Ecology and Management* (2021) 494: 119322. doi.org/10.1016/j.foreco.2021.119322.

[119] Boone, C.K. et al. "Efficacy of tree defense physiology varies with bark beetle population density: a basis for positive feedback in eruptive species." *Canadian Journal of Forest Research* (2011) 41(6): 1174–1188. https://doi.org/10.1139/x11-041.

successful colonization of a weakened tree.[120] From there, the colonizing insect can spread to the surrounding trees.[121] The impact of insect activity on the forest is dependent on many factors, including the kind of insects, if it is a defoliator or a wood borer, the insect's range, and more.[122]

Generally, stressed stands are more susceptible to secondary disturbances, such as insects. The compounding of multiple stressors or disturbances is more likely to lead to tree mortality, rather than any one disturbance alone. The interactions among these stressors are multivariate, complex, and vary between dry, frequent-fire forests, and more moist, infrequent-fire forests.[123] Old-growth trees are generally well positioned to effectively weather combined drought and insect stress, thanks to—among other things—their ability to regulate water better than young trees.[124]

Moreover, removing old-growth trees is not likely to change the course of insect increases.[125] These trees are not driving insect population trends, which are significantly reliant on abiotic factors.[126] While certain insects—such as mountain pine beetles—target older trees, they tend to do so because of the rich nutrients in the phloem of the trees which support brood production, not due to an age-related susceptibility.[127] And they are generally only able to successfully colonize once the insect population has already surpassed the threshold

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[120] Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas Journal* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107; Krokene, P. "Conifer Defense and Resistance to Bark Beetles." In: "Bark Beetles: Biology and Ecology of Native and Invasive Species." *Elsevier* (2015) 177–207. Edited by F.E. Vega and R.W. Hofstetter. http://dx.doi.org/10.1016/B978-0-12-417156-5.00005-8.

[121] Stephenson, N.L. et al. "Which trees die during drought? The key role of insect host-tree selection." Journal of Ecology (2019) 107(5): 2383–2401. https://doi.org/10.1111/1365-2745.13176.

[122] Kneeshaw, D. et al. "The vision of managing for pest-resistant landscapes: realistic or utopic?" *Forest Entomology* (2021) 7: 97–113. https://doi.org/10.1007/s40725-021-00140-z.

[123] Anderegg, W.R.L., et al. "Tree mortality from drought, insects, and their interactions in a changing climate." *New Phytologist* (2015) 208(3): 674–683. https://doi.org/10.1111/nph.13477; Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas Journal* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.

[124] Jones, J. et al. "Forest restoration and hydrology." Forest Ecology and Management (2022) 520: 120342. https://doi.org/10.1016/j.foreco.2022.120342; Farinacci, M.D. et al. "Carbon-water tradeoffs in old-growth and young forests of the Pacific Northwest." *AGU Advances* (2024) 5(4): e2024AV001188. https://doi.org/10.1029/2024AV001188.

[125] *See, e.g.*, Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x.

[126] *See, e.g.*, Fettig, C.J. and J. Hilszczanki, "Management Strategies for Bark Beetles in Conifer Forests." In: In: "Bark Beetles: Biology and Ecology of Native and Invasive Species." *Elsevier* (2015) 555–584. Edited by F.E. Vega and R.W. Hofstetter. http://dx.doi.org/10.1016/B978-0-12-417156-5.00005-8; Boone, C.K. et al. "Efficacy of tree defense physiology varies with bark beetle population density: a basis for positive feedback in eruptive species." *Canadian Journal of Forest Research* (2011) 41(6): 1174–1188. https://doi.org/10.1139/x11-041; Kolb, T.E. et al. "Observed and anticipated impacts of drought on forest insects and diseases in the United States." *Forest Ecology and Management* (2016) 380: 321–334. https://doi.org/10.1016/j.foreco.2016.04.051.

[127] Boone, C.K. et al. "Efficacy of tree defense physiology varies with bark beetle population density: a basis for positive feedback in eruptive species." *Canadian Journal of Forest Research* (2011) 41(6): 1174–1188. https://doi.org/10.1139/x11-041; Fettig, C.J. et al. "The Effectiveness of Vegetation Management Practices for Prevention and Control of Bark Beetle Infestations in Coniferous Forests of the Western and Southern United States." *Forest Ecology Management* (2007) 238(1): 24–53. https://doi.org/10.1016/j.foreco.2006.10.011.

needed to overcome the defenses such trees are able to bring to bear.[128] Nevertheless, the oldest trees within these forests are the proven survivors of decades and centuries of such disturbance cycles, with robust defensive mechanisms.[129] This is reflected in the fact that only three percent of old-growth forests were identified as having high or very high exposure risk to insect and disease increases.[130]

b. Insect activity promotes forest complexity.

Under climate change conditions, some insect species are undoubtedly at an advantage—warmer overwinter temperatures and longer growing seasons are keeping them alive and well fed for more of the year, increasing breeding cycles.[131] Due to this, insects and disease are listed as the second greatest threat to old-growth forests in the USDA Threat Assessment, following wildfire.[132] However, insect activity and outbreak events are an essential part of forest ecology, and any management framework must be calibrated appropriately.

At low to moderate levels, insect activity poses little threat to old-growth forests. Heightened insect activity can aid in the development of several structural components that actually increase old-growth forest conditions, as stated in the NOGA threat analysis, "[r]esults suggest no significant change in mature forest area but a significant net gain in old-growth area, likely owing to increases in dead tree components that are elements of some old growth definitions."[133]

As a natural thinning agent, insect driven tree-mortality can help reduce stand density and intraspecific competition, create snags and cultivate decadence which serve as critical habitat, and open natural gaps in the forest canopy to increase heterogeneity of plants and tree age diversity.[134] Indeed, where stand density is a concern, the natural reduction in basal area brought on by insect disturbances in these forests may be beneficial to the overall system, allowing for thinning benefits without the negative impacts associated with mechanical treatments. Increased insect activity can also influence bird population densities, as several species of insectivorous birds have evolved to make use of this short-term and cyclical superabundance of food.[135]

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[128] Boone, C.K. et al. "Efficacy of tree defense physiology varies with bark beetle population density: a basis for positive feedback in eruptive species." *Canadian Journal of Forest Research* (2011) 41(6): 1174–1188. https://doi.org/10.1139/x11-041.

[129] *See, e.g.*, Schowalter T. "Arthropod Diversity and Functional Importance in Old-Growth Forests of North America." *Forests* (2017) 8(4):97. https://doi.org/10.3390/f8040097; Lynch, A.M. and T.W. Swetnam. "Old-growth Mixed Conifer and Western Spruce Budworm in the Southern Rocky Mountains." In: "Old-Growth Forests in the Southwest and Rocky Mountain Regions: Proceedings of a Workshop." *USDA Forest Service* Gen. Tech. Report RM-213. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO (1992) 66–80. Edited by M.R. Kaufman, W.H. Moir, R.L. Bassett. https://doi.org/10.2737/RM-GTR-213.

[130] USDA Forest Service and Bureau of Land Management, Mature and Old-Growth Forests: Analysis of Threats on Lands Managed by the Forest Service and Bureau of Land Management, in Fulfillment of Section 2(c) of Executive Order No. 14072 Fig. 12 at 30 (June 2024) ("Threat Assessment" or "TA").

[131] Aoki, C.F. et al. "Old Pests in New Places: Effects of Stand Structure and Forest Type on Susceptibility to a Bark Beetle on the Edge of Its Native Range." *Forest Ecology Management* (2018) 419–420: 206–219. https://doi.org/10.1016/j.foreco.2018.03.009; Potter, K.M. et al. "Important Insect and Disease Threats to United States Tree Species and Geographic Patterns of Their Potential Impacts." *Forests* (2019) 10(4): 304. https://doi.org/10.3390/f10040304.

[132] TA at 63.

[133] *Id.* at 27.

[134] Swanson, M.E. et al. "The Forgotten Stage of Forest Succession: Early-Successional Ecosystems on Forest Sites." *Frontiers in Ecology and the Environment* (2010) 9(2): 117–125. https://doi.org/10.1890/090157; Donato, D.C. et al. "Multiple Successional Pathways and Precocity in Forest Development: Can Some Forests Be Born Complex?" *Journal of Vegetation Science* (2012) 23(3): 576–584. https://doi.org/10.1111/j.1654-1103.2011.01362.x.

[135] Venier, L.A. and Holmes, S.B. "A review of the interaction between forest birds and eastern spruce budworm." *Environmental Reviews* (2010) 18(1): 191–207. https://doi.org/10.1139/A10-009.

This kind of recurring disturbance is a natural part of old growth development for many forest types around the country.[136]

The analysis in the DEIS tends to obscure this nuanced relationship between climate change and insect prevalence. The DEIS does not consider the typical rates or historic range of natural insect activity, which makes it difficult to determine where insect activity is uncharacteristic, where they are an ecologically appropriate disturbance activity, and where insect activity is beneficial (e.g., old-growth forests support high diversity of arthropods, adept predators of defoliators).[137] Similarly, the data in Figure 10 of the Draft Ecological Impacts Analysis does not break out defoliation, a milder disturbance from which most trees will recover, from insect-related mortality, nor does it draw the distinction between native and non-native insect activity.[138]

c. Logging old-growth trees or infrequent-fire old-growth forests is counterproductive to insect management.

Neither the DEIS nor the broader scientific literature provides a basis for granting broad discretion to log old growth in a bid to manage insects—at best, they suggest a carefully targeted approach to management. There is little scientific basis for active insect management in moist old-growth forests, as these forests are most able to resist and recover from insect outbreaks. And, in dry old-growth forests, management interventions should focus on younger tree removal with tools like prescribed fire and, in certain circumstances, variable density thinning from below. Importantly, a literature review of beetle suppression efforts found the effectiveness of many beetle timber harvest treatments to be uncertain.[139] And this uncertainty is compounded by the high financial costs of treatments, the effect on other environmental values, and how such treatments intersect or interfere with climate change adaptation.[140]

The effects of increased insect activity depend on a variety of conditions that vary by region and forest type.[141] In dry, frequent-fire forests under drought conditions, active management, including prescribed burns, may be an appropriate response well in advance or sometimes in response to small, ***early-stage*** outbreaks.[142] But management should focus on the younger trees within the stand, while the old-growth trees should be retained for their myriad values. From there, it is the specific site, management activity, and implementation method that will determine the effectiveness of intervention.[143] More broadly, research

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136 Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas J.* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.

137 Schowalter, T. "Arthropod diversity and functional importance in old-growth forests of North America." *Forests* (2017) 8(4): 97. https://doi.org/10.3390/f8040097.

138 DEIAR at Fig. 10 at 34.

139 Six, D. et al. "Management for Mountain Pine Beetle Outbreak Suppression: Does Relevant Science Support Current Policy?" *Ecosystem and Conservation Sciences Faculty Publications* (2014) 5(1): 48. https://doi.org/10.3390/f5010103.

140 *Id.*

141 Kneeshaw, D. et al. "The vision of managing for pest-resistant landscapes: realistic or utopic?" *Forest Entomology* (2021) 7: 97–113. https://doi.org/10.1007/s40725-021-00140-z.

142 Fettig, C.J. et al. "The Effectiveness of Vegetation Management Practices for Prevention and Control of Bark Beetle Infestations in Coniferous Forests of the Western and Southern United States." *Forest Ecology Management* (2007) 238(1-3): 24–53. https://doi.org/10.1016/j.foreco.2006.10.011; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." Natural Areas J. (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.

143 Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas J.* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.

suggests that once an epidemic has begun, logging will not alter the trajectory of an insect outbreak.[144] In fact, thinning operations can open up vectors for non-native species movement and harm the remaining forest system, with access roads and machinery damaging surviving trees and compacting soil, negatively affecting tree growth.[145]

Mountain pine beetles are a bark beetle species native to the Rocky Mountains,[146] and these beetles seek to colonize infected, decaying trees more often than healthy trees.[147] Paired with the potential for brood hatch from the downed trees themselves, management can in some cases actually exacerbate outbreak conditions - not curb them. The restoration of natural fire regimes on the landscape may, in some frequent-fire forests, prove a more effective management prescription as it minimizes this key weakness (decaying logging residuals) in the implementation of thinning projects. Thinning from below to remove brush and reduce small understory tree density, paired with conducting a prescribed or cultural burn can help manage outbreaks by curbing the insect population from the ground up.[148]

As climate change broadens hospitable ranges for insects, the opportunity for colonization by non-native insects will increase in turn.[149] The movements of non-native insect populations should be monitored, when possible, because given the unpredictability of both invasion and ecosystem response, an advance notice from monitoring and reporting will provide more options should management actions be necessary.

4. Extreme weather

The DEIS fails to demonstrate that extreme weather is a threat to old-growth, or that active management is necessary or beneficial to combat this perceived threat. Rather, both the DEIS and the Threat Assessment collectively provide evidence that a) weather events are predominantly beneficial for forest structural complexity and biodiversity; and b) protecting both old-growth forests *and* surrounding mature forests (to recruit future old-growth) provides maximum insurance against random extreme weather events and buffers old-growth from threats such as the spread of invasive species.

a. Definitional inconsistencies

The agency should clarify its definition of "extreme weather," as the phrase is used inconsistently and in reference to various phenomenon. The TA describes "extreme weather" as "[i]ce storms, windstorms (including hurricanes and tornadoes), flooding, and landslides [as] some examples."[150] Meanwhile, the DEIS

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144 Potter, K.M. et al. "Important Insect and Disease Threats to United States Tree Species and Geographic Patterns of Their Potential Impacts." *Forests* (2019) 10(4): 304. https://doi.org/10.3390/f10040304; Black, S.H., et al. "Insects and Roadless Forests: A Scientific Review of Causes, Consequences and Management Alternatives." *National Center for Conservation Science and Policy,* Ashland OR (2010). https://xerces.org/publications/scientific-reports/insects-and-roadless-forests.
145 Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas J.* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.
146 Aoki, C.F. et al. "Old Pests in New Places: Effects of Stand Structure and Forest Type on Susceptibility to a Bark Beetle on the Edge of Its Native Range." *Forest Ecology Management* (2018) 419–420: 206–219. https://doi.org/10.1016/j.foreco.2018.03.009.
147 Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x; Black, S.H. et al. "Do Bark Beetle Outbreaks Increase Wildfire Risks in the Central U.S. Rocky Mountains? Implications from Recent Research." *Natural Areas J.* (2013) 33(1): 59–65. https://doi.org/10.3375/043.033.0107.
148 *Id.*; Parker, T.J. et al. "Interactions among Fire, Insects and Pathogens in Coniferous Forests of the Interior Western United States and Canada." *Agricultural and Forest Entomology* (2006) 8(3): 167–189. https://doi.org/10.1111/j.1461-9563.2006.00305.x.
149 Potter, K.M. et al. "Important Insect and Disease Threats to United States Tree Species and Geographic Patterns of Their Potential Impacts." *Forests* (2019) 10(4): 304. https://doi.org/10.3390/f10040304.
150 TA at 31.

describes "extreme weather" as "e.g. droughts, flooding, hurricanes, tornadoes, severe thunderstorms."[151] Elsewhere in both documents, the evidence provided relies on measurements of low, moderate, and high-intensity weather events.[152]

In contrast, a recent peer-reviewed study defined intermediate-severity wind events as "partial canopy disturbances that result from strong winds associated with thunderstorms, microbursts, macrobursts, derechos, and low-grade tornadoes."[153] It is unclear whether the Forest Service considers these events to be extreme or not. Furthermore, wind events typically have heterogeneous impacts that "impart a large range of stand-scale severity (i.e., tree mortality) while spanning multiple spatiotemporal scales, from frequent, small, gap-forming events (e.g., Frelich and Lorimer 1991, Lorimer and White 2003, Nagel et al. 2017) to infrequent, regional hurricane events with large extent but variable severity (e.g., Foster and Boose 1992, Sano et al. 2010, D'Amato et al. 2017)."[154]

b. Extreme weather is not a significant threat to old growth.

The evidence provided by the agency does not support a conclusion that extreme weather is a significant threat to old-growth trees or stands. Instead, the evidence provided suggests that weather events typically create a mosaic of impacts, mostly beneficial. Indeed, the TA notes that "[t]hreats from extreme weather and abiotic events are much more isolated [than other threats assessed in the document] and their impacts are highly dependent on the ecosystem."[155] Where old-growth stands are threatened simply by virtue of being rare, this can and must be counteracted by recruiting additional old-growth forests from the pool of mature stands.

Agency analysis also notes that "[e]xtreme weather events are a natural component of forest ecosystems across the nation, typically producing disturbances in small patches and killing limited numbers of large trees. Based on FIA plot remeasurements since the start of this century, extreme weather events have not accounted for much change in the extent of old-growth forests."[156] In fact, the TA states that "[a]n estimated 1.1 million acres of mature forest (1.4 percent of all mature forest) and an estimated 0.6 million acres of old-growth forest (1.8 percent of all old growth) were disturbed by weather between remeasurements. In forests disturbed by weather, there was an 83,000-acre (0.1 percent) decrease of mature forest and a 10,000-acre (0.03 percent) increase of old-growth forest."[157]

The evidence presented shows that weather events typically have beneficial impacts to older forests.[158] And it further acknowledges that weather events create snags and increase the amount of downed woody debris.[159] A recent peer-reviewed study found that "that intermediate-severity wind disturbances can contribute to stand-scale structural complexity as well as development toward late-successional species composition," and "landscape-scale heterogeneity and associated values prioritized by many contemporary forest policies (e.g., wildlife habitat, ecosystem services…)."[160] The same study adds: "intermediate-severity disturbances represent a subsidy to the system, enhancing the availability of otherwise under-represented spatial patterns

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151 DEIAR at 36.

152 *See* TA at 31, 32, and 33; *see also* DEIAR at 37.

153 Meigs, G.W. and Keeton, W.S. "Intermediate-severity wind disturbance in mature temperate forests: legacy structure, carbon storage, and stand dynamics." *Ecological Applications* (2018) 28(3): 798–815. https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.1691.

154 *Id.*

155 TA at 31.

156 DEIAR at 36–37.

157 TA at 31.

158 DEIAR Fig. 11 at 37.

159 TA at 31.

160 Meigs, G.W. and W.S. Keeton. "Intermediate-severity wind disturbance in mature temperate forests: legacy structure, carbon storage, and stand dynamics." *Ecological Applications* (2018) 28(3): 798–815. https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.1691.

and habitat features, such as gaps and canopy openings of irregular shape, size, and within-patch residual structure."[161]

Even when severe weather occurs (defined as "greater than or equal to 90 percent basal area loss"[162]) mature and old-growth forests experienced minimal losses of 1.3% and 1.5% respectively.[163] But this is a natural trajectory for an old-growth stand. The weather events create complex mature or early successional habitat without any active management, thereby avoiding the financial and ecological costs of logging (including spread of invasive species, water quality reduction, increased flood risk, habitat fragmentation, and more). The conversion of old-growth to an earlier stage of succession due to natural processes is hardly a threat to old-growth forests writ large when it occurs within a broader forest that is allowed to function and age according to natural successional processes.

c. Extreme weather impact mitigation benefits of older forests

The agency leaves unanalyzed the benefits of older forests for flood mitigation, which is an increasingly important role of National Forests, especially in locations where extreme precipitation is expected to increase with climate change. A 2023 study projects that "[b]y the mid-21st century," there will be "unprecedented rainfall events over the [Northeast US], driven by increasing anthropogenic radiative forcing and distinguishable from natural variability. Very extreme events (>150 mm/day) may be six times more likely by 2100 than in the early 21st century."[164]

Characteristics of old-growth forests—including large live and dead trees, large quantities of downed woody debris, tip-up mounds, and associated pit and mound micro-topography—all contribute to increased flood mitigation and resilience[165] as well as improved water quality protection and enhancement.[166] A 2017 study notes,

> LW [(large wood)] accumulations in stream channels provide important ecological functions such as debris dam and plunge-pool formation and associated retention of fine sediment (Bilby and Ward 1991; Montgomery et al. 1995; Díez et al. 2000; Valett et al. 2002). In turn, these processes can positively influence channel geometry and stability (Gurnell 1997; Kraft et al. 2011). LW inputs and associated effects on lower order stream geomorphology are strongly correlated with riparian stand age and structure in northern hardwood–conifer systems (Keeton et al. 2007; Warren et al. 2009)… LW volumes and large log frequency are predicted to increase with forest age in the US Northeast (Warren et al. 2009).[167]

If mature and old-growth stands are also managed to reduce or eliminate networks of roads and skid trails, as in areas managed according to the 2001 Roadless Area Conservation Rule, such forests become even more effective tools for climate resilience. As noted in the Roadless Rule, "[h]ealthy watersheds catch, store, and safely release water over time, protecting downstream communities from flooding."[168] The Rule continues:

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[161] *Id.*
[162] TA at 31.
[163] *Id.* at 31–32.
[164] Jong, B. et al. "Increases in extreme precipitation over the Northeast United States using high-resolution climate model simulations." *npj Climate and Atmospheric Science* (2023) 6(18). https://doi.org/10.1038/s41612-023-00347-w.
[165] Keeton, W.S. et al. "Riparian forest structure and stream geomorphic condition: implications for flood resilience." *Canadian J. of Forest Research* (2017) 47(4): 476–487. https://doi.org/10.1139/cjfr-2016-0327.
[166] Warren, D. et al. "Forest-Stream Interactions in Eastern Old-Growth Forests." In: "Ecology and Recovery of Eastern Old-Growth Forests." *Island Press* (2018) Ch. 9, pp. 159–178. Edited by Barton, A.M., and Keeton, W.S. (2018). https://doi.org/10.5822/978-1-61091-891-6_9.
[167] Keeton, W.S. et al. "Riparian forest structure and stream geomorphic condition: implications for flood resilience." *Canadian J. of Forest Research* (2017) 47(4): 476–487. https://doi.org/10.1139/cjfr-2016-0327.
[168] 66 Fed. Reg. 3,244, 3,245: Special Areas; Roadless Area Conservation (Jan. 12, 2001).

> Without the disturbance caused by roads and associated activities, stream channels are more likely to function naturally (FEIS Vol. 1, 3-54). Current road construction and timber harvest practices reduce the potential for damage associated with the use of earlier and less sophisticated techniques. However, even with today's improved design standards for road construction and timber harvest, these activities can still result in adverse effects to watersheds. These effects include pollution, changes to water temperatures and nutrient cycles, and increased sediment from storm or runoff events that exceed road design standards (FEIS Vol. 1, 3-45 to 3-50).[169]

Protecting and expanding old-growth forests across the National Forest System is an essential strategy for addressing extreme weather. The agency should assess the benefits of mature and old-growth forests for extreme weather impact mitigation and resilience. Such an analysis should also look at the benefits of avoiding future road construction and reconstruction in mature and old-growth stands. This analysis is currently missing from the Forest Service's documentation. If the Forest Service properly considers the unique contributions of existing and future old-growth forests for flood risk reduction, it may come to a different set of conclusions for mature and old-growth management.

5. Mesophication

The DEIS posits mesophication as a significant threat to old-growth in Forest Service Regions 8 and 9.[170] We do not dispute that mesophication is occurring, but the Forest Service must recognize two critical points: first, mesophication is not a justification for cutting old-growth trees or infrequent-fire old-growth stands. And second, mesophication is generally not a threat to old-growth forests, and logging to prevent it is usually not necessary or net beneficial.

In Appendix C, we present broad concerns about the agency's logging-based approach to mesophication. Here, we make the narrower point that mesophication does not require the Forest Service to log infrequent-fire old-growth stands, nor is it a logical rationale for doing so. The DEIS describes mesophication as "the transition of oak, hickory, and other *frequent-fire* deciduous forests to shade-tolerant, late successional species-dominated forests."[171] The characterization that forest types subject to mesophication are frequent-fire is borne out by a more granular analysis of forest types. For example, under the agency's own classification system, oak-hickory forests in the Great Lakes region, Appalachian and Southern Appalachian oak forests, and Coastal Plain pine-oak-hickory forests are all categorized as LANDFIRE Fire Regime Group 1—the Group with the most frequent fire-return interval.[172] Even if the agency resorts to logging to address mesophication in old-growth forests (which is generally unnecessary), there is no reason to direct those efforts toward infrequent-fire old growth.

Mesophication is also not a reason to cut old-growth trees. The DEIS describes mesophication as a process by which younger trees crowd out older trees—"secondary forest cover replacing old-growth forests."[173] For example, the DEIS references red maple spreading into preexisting "oak-pine and oak-dominated ecosystems."[174] Any cutting to address mesophication in old-growth forests would logically be directed at the younger trees rather than the old-growth trees that the agency is trying to safeguard.

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[169] *Id.* at 3,247.
[170] *See* DEIAR at 24.
[171] DEIS at 65 (emphasis added). *See also id.* at G-2 (defining mesophication as "[t]he transformation of fire-maintained open forest to closed-canopy forest resulting from replacement of heliophytic (sun loving), fire-tolerant plants by shade-tolerant, fire-sensitive plants following extended fire suppression and elimination of cultural burning. This transformation results in gradual decline and loss of oak, oak-hickory, and oak-pine forests that once were in an open old-growth stage of development (Nowacki and Abrams 2008, Abrams et al. 2022).").
[172] Fryer, J.L. and P.S. Luensmann. "Fire regimes of the conterminous United States." In: "Fire Effects Information System, [Online]." USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2012). https://www.fs.usda.gov/database/feis/fire_regime_table/fire_regime_table.html.
[173] DEIAR at 24.
[174] DEIS at 76.

Additional concerns and recommendations about the agency's approach to mesophication appear in Appendix C.

iii. Protecting old-growth trees and infrequent-fire old-growth forests from logging will not hamper the agency's ability to pursue appropriate work.

The DEIS discloses no economic rationale for continuing to log old-growth trees or infrequent-fire old-growth stands. The analysis explicitly notes that "[c]urrent vegetation management practices on federal lands typically preserve larger diameter, older trees."[175] The analysis acknowledges that "[t]he timber industry adjusted to steep declines in Forest Service harvest in the 1990s by retooling to mill smaller diameter logs."[176] And it generally notes that the focus of vegetation treatments should be in "more frequent disturbance regimes."[177] The DEIS does not provide any evidence that commercial exchange of this old growth is a driver of economic activity. And protecting this old growth would not prevent other timber sales within the National Forest System or on other lands.

Nor is there an economic rationale to sell this old growth to fund restoration activity. The DEIS indicates that Alternative 3 as written would eliminate "all timber sale contracts, end result stewardship contracts and agreements" from use in old-growth forests.[178] The analysis suggests Alternative 3 would "limit[] choices of treatment options and ration[] the ecological and economic benefits of restoration through triage."[179]

As noted above, Alternative 3 in the DEIS bluntly prohibits proactive stewardship from any old-growth forest from resulting in commercial timber harvest, which is an overbroad distortion of a proposal submitted to the agency in prior public comments. In frequent-fire forests, a properly crafted Alternative 3 would prohibit only old-growth *trees* from proactive stewardship resulting in commercial harvest. The DEIS does not state that the agency needs to cut old-growth trees or infrequent-fire old-growth stands to support appropriate restoration work. The analysis, in fact, points in the opposite direction. As discussed above, the DEIS indicates that the locus of restoration activity should be frequent-fire forests that have been badly degraded by past management. And it repeatedly emphasizes the importance of retaining old-growth trees.[180] At most, the DEIS suggests a rationale for allowing the commercial exchange of sub-old-growth trees from frequent-fire old-growth forests, which would be allowed under a corrected Alternative 3.

B. OLD-GROWTH FORESTS DELIVER A WIDE RANGE OF ESSENTIAL CLIMATE AND ECOSYSTEM BENEFITS WHEN LEFT INTACT.

i. Old-growth trees and stands deliver significant carbon storage and sequestration benefits.

The DEIS recognizes that old-growth trees are carbon storage powerhouses. It clearly discloses their "important role in carbon stock accumulation."[181] They play a key role in storing carbon for long periods of time and they are essential to the climate role that old stands play. And, if left alone, they can continue playing this role well past their death. Logging these trees severely curtails this core climate benefit.

The DEIS does not dispute the science showing that old-growth trees continue to sequester carbon at a high rate until they die.[182] As a tree ages and grows larger, research indicates that it will continue to absorb carbon at an increasing rate.[183] As it develops, a tree's total leaf area increases, which means more light can be

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175 USDA Forest Service, *Draft Social, Economic and Cultural Impacts Analysis Report for the DEIS for Amendments to LMPs to Address Old-Growth Forests Across the NFS* 24–25 (June 2024).
176 *Id.* at 34.
177 *Id.* at 25.
178 *Id.* at 38.
179 *Id.* at 37.
180 *See infra* at III.B; DEIAR at 24–25.
181 DEIAR at 24; *id.* at 13–16.
182 Stephenson, N.L. et al. "Rate of tree carbon accumulation increases continuously with tree size." *Nature* (2014) 507: 90–93. https://doi.org/10.1038/nature12914.
183 *Id.*

intercepted, which in turn, through photosynthesis, means more atmospheric carbon is absorbed.[184] Moreover, the increase in the rate of carbon accumulation continues even as a tree's overall growth rate per unit leaf area declines.[185] The result of this biological development is that older, larger trees hold significantly more carbon than their younger brethren in the forest.[186]

And older trees can store their accumulated carbon for centuries. As a tree ages and continues to absorb carbon, the absolute amount of its stored carbon increases.[187] Older, larger trees can hold a substantial portion of a forest's total above-ground carbon even though they account for a relatively small percent of the trees.[188] Further, research indicates that, once dead, such trees often decay more slowly than smaller, younger trees.[189] If these dead trees remain in the forest, they can hold onto their stored carbon for decades—or centuries—as they slowly decay.[190] And even then not all carbon is lost to the atmosphere—much is absorbed into the forest soil.[191]

Although carbon dynamics operate differently at the stand-level, the high rate of carbon accumulation in a stand of trees does not suddenly collapse as forests mature.[192] For example, recent research in infrequent-fire forests of the Northeast US reveals that carbon sequestration rates in mature stands in passive management are equal or superior to sequestration rates in recently harvested stands.[193] As a stand of trees ages, that rate of carbon sequestration will peak around the time the canopy closes. The causes of this peak are complex and

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[184] *Id.*; Xu, C-Y. et al. "Age-related decline of stand biomass accumulation is primarily due to mortality and not to reduction in NPP associated with individual tree physiology, tree growth or stand structure in a *Quercus*-dominated forest." *Journal of Ecology* (2012) 100(2): 428–440. https://doi.org/10.1111/j.1365-2745.2011.01933.x; Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274.

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

[186] Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274; Lutz, J.A. et al. "Global importance of large-diameter trees." *Global Ecology and Biogeography* (2018) 27(7): 849–864. https://doi.org/10.1111/geb.12747; Brown, S.L. et al. "Spatial distribution of biomass in forests of the eastern USA." *Forest Ecology and Management* (1999) 123(1): 81–90. https://doi.org/10.1016/S0378-1127(99)00017-1.

[187] Xu, C-Y. et al. "Age-related decline of stand biomass accumulation is primarily due to mortality and not to reduction in NPP associated with individual tree physiology, tree growth or stand structure in a *Quercus*-dominated forest." *Journal of Ecology* (2012) 100(2): 428–440. https://doi.org/10.1111/j.1365-2745.2011.01933.x; Pregitzer, K.S. and E.S. Euskirchen. "Carbon cycling and storage in world forests: biome patterns related to forest age." *Global Change Biology* (2004) 10(12): 2052–2077. https://doi.org/10.1111/j.1365-2486.2004.00866.x; Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274.

[188] Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274; Lutz, J.A. et al. "Global importance of large-diameter trees." *Global Ecology and Biogeography* (2018) 27(7): 849–864. https://doi.org/10.1111/geb.12747; Brown, S.L. et al. "Spatial distribution of biomass in forests of the eastern USA." *Forest Ecology and Management* (1999) 123(1): 81–90. https://doi.org/10.1016/S0378-1127(99)00017-1.

[189] Harmon, M.E. et al. "Ecology of Coarse Woody Debris in Temperate Ecosystems." *Advances in Ecological Research* (1986) 15: 133–302. https://doi.org/10.1016/S0065-2504(08)60121-X; Herrmann, S. et al. "Decomposition dynamics of coarse woody debris of three important central European tree species." *Forest Ecosystems* (2015) 2(27): https://doi.org/10.1186/s40663-015-0052-5.

[190] Lutz, J.A. et al. "The importance of large-diameter trees to the creation of snag and deadwood biomass." *Ecological Processes* (2021) 10(28). https://doi.org/10.1186/s13717-021-00299-0; Stenzel, J.E. et al. "Fixing a snag in carbon emissions estimates from wildfires." *Global Change Biology* (2019) 25(11): 3985–3994. https://doi.org/10.1111/gcb.14716.

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

[192] DEIAR at 14–15.

[193] Faison, E.K. et al. "Adaptation and mitigation capacity of wildland forests in the northeastern United States." *Forest Ecology and Management* (2023) 544: 121145. https://doi.org/10.1016/j.foreco.2023.121145.

not fully understood,[194] but population dynamics—e.g., trees dying and taking their sequestration ability with them—play a key role.[195] The timing of the peak varies based on species and growing conditions (e.g., climate, competition).[196] Following the peak, the rate of accumulation in some conditions will decelerate toward equilibrium (carbon in equaling carbon out);[197] in others, it will remain relatively constant, decelerating gradually, if at all.[198] But, as a general matter, the rate of carbon accumulation remains robust well into a stand's lifespan.[199]

These carbon benefits are true in both the eastern and western U.S. One report in the west showed that "large trees accounted for 2.0 to 3.7% of all stems (DBH ≥ 1" or 2.54 cm) among five tree species; but held 33 to 46% of the total AGC [above-ground carbon] stored by each species."[200] In the eastern U.S., "[a]boveground live biomass was significantly . . . different between mature (195 Mg/ha) and old-growth (266 Mg/ha) sites,"[201] showing the importance of looking at both carbon and area when quantifying the natural value of mature and old-growth forests and trees and the effects of disturbance. Keeton et al. notes that the difference in aboveground biomass density would be even more pronounced between young and old-growth stands.[202] Minimizing, and in many places eliminating, logging in forests preserves a large carbon sink today and into the future.[203]

Notwithstanding the DEIS's acknowledgement of the critical role old trees play in carbon benefits, it fails to fully disclose the deleterious impacts of logging on carbon stored in old-growth trees. It acknowledges that such logging can lead to carbon loss. But it relies on a fuzzy, generic analysis of how management activities could potentially yield "carbon stability."

The scientific literature shows that logging generally releases much of a tree's stored carbon to the atmosphere in a relatively short time. This release occurs through the transportation, manufacturing process,

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194 Kutsch, W.L. et al. "Ecophysiological characteristics of mature trees and stands – Consequences for old-growth forest productivity." In: "Old-growth forests." *Springer* (2009) 57–79. Edited by C. Wirth et al. https://doi.org/10.1007/978-3-540-92706-8_4.

195 Xu, C-Y. et al. "Age-related decline of stand biomass accumulation is primarily due to mortality and not to reduction in NPP associated with individual tree physiology, tree growth or stand structure in a *Quercus*-dominated forest." *Journal of Ecology* (2012) 100(2): 428–440. https://doi.org/10.1111/j.1365-2745.2011.01933.x; Acker, S.A. et al. "Trends in bole biomass accumulation, net primary production and tree mortality in *Pseudotsuga menziesii* forests of contrasting age." *Tree physiology* (2002) 22: 213–17. https://doi.org/10.1093/treephys/22.2-3.213; Lorenz K. and R. Lal. "Carbon sequestration in forest ecosystems" *Springer* (2010) chapter 3: 103–57. "Effects of disturbance, succession and management on carbon sequestration." https://doi.org/10.1007/978-90-481-3266-9_3.

196 He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26: GB3009. https://doi.org/10.1029/2010GB003942.

197 Hudiburg, T.W. et al. "Carbon dynamics of Oregon and Northern California forests and potential land-based carbon storage." *Ecological Applications* (2009) 19(1): 163–80. https://doi.org/10.1890/07-2006.1; Pregitzer and Euskirchen 2004.

198 Gough, C.M. et al. "Disturbance, complexity, and succession of net ecosystem production in North America's temperate deciduous forests." *Ecosphere* (2016) 7(6): e01375. https://doi.org/10.1002/ecs2.1375.

199 He, L. et al. "Relationships between net primary productivity and forest stand age in U.S. forests." *Global Biogeochemical Cycles* (2012) 26: GB3009. https://doi.org/10.1029/2010GB003942; Keeton, W.S. et al. "Late-successional biomass development in northern hardwood-conifer forests of the Northeastern United States." *Forest Science* (2011) 57(6): 489–505. https://doi.org/10.1093/forestscience/57.6.489.

200 Mildrexler, D.J. et al. "Large trees dominate carbon storage in forests east of the Cascade Crest in the United States Pacific Northwest." *Frontiers in Forests and Global Change* (2020) 3: 594272. https://doi.org/10.3389/ffgc.2020.594274.

201 Keeton, W.S. et al. "Late-successional biomass development in northern hardwood-conifer forests of the Northeastern United States." *Forest Science* (2011) 57(6): 489–505. https://doi.org/10.1093/forestscience/57.6.489.

202 *Id.*

203 Birdsey, R. et al. "Middle-aged forests in the Eastern U.S. have significant climate mitigation potential." *Forest Ecology and Management* (2023) 584: 121373. https://doi.org/10.1016/j.foreco.2023.121373.

and end use (and particularly if the biomass is burned for energy).[204] Substantial quantities of logging debris will decompose or be burned, a carbon loss frequently under-reported.[205] The milling of logs into products quickly releases substantial stored carbon from the harvested tree boles.[206]

Losses from decomposition of wood products vary over time and depend on the lifespan of the product being generated from the timber. Paper, wood chips, and bioenergy sources, for example, have very short lifetimes and will release substantial carbon into the atmosphere within a few months to a few years of production. Product disposal in landfills results in anaerobic decomposition that releases methane. Methane has a global warming potential about 30 times that of carbon dioxide over 100 years, and over 80 times that of carbon dioxide over 20 years,[207] magnifying the immediate impact of disposal of short-term wood products.

Longer term wood products can store carbon for many decades, but this depends on the life of the product. To give a sense of the larger picture, a study modeling carbon stores in Oregon and Washington from 1900-1992 showed that only 23% of carbon from logged trees during this period was still stored as of 1996.[208] Similarly, more than 80% of carbon removed from forests in logging operations in West Coast forests since 1900 was transferred to landfills and the atmosphere within decades.[209] Additionally, state and federal carbon reporting have underestimated 25-55% of state total carbon emissions from logging.[210] Importantly, the longevity of carbon storage in wood products cannot match the longevity of carbon storage in mature and old-growth forests.[211]

In summary, old-growth trees provide myriad carbon storage and sequestration benefits. Logging them eliminates their ability to sequester carbon and results in short-term emission of much of their carbon. To ensure these trees can continue to supply these critical ecosystem services the agency should adopt a standard that keeps them in the forest.

ii. Old-growth trees and stands provide essential contributions to watershed integrity.

As written, the preferred alternative will undermine the watershed health and integrity benefits the DEIS discloses. USFS clearly acknowledges the value of old-growth forests to watershed health and integrity. However, the preferred alternative would allow for the continued logging of old-growth trees with little functional limitation.

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[204] Law, B.E. et al. "Land use strategies to mitigate climate change in carbon dense temperate forests." *Proceedings of the National Academy of Sciences of the United States of America* (2018) 115(14): 3663–3668. https://doi.org/10.1073/pnas.1720064115; Hudiburg, T.W. et al. "Meeting GHG reduction targets requires accounting for all forest sector emissions." *Environmental Research Letters* (2019) 14: 095005. https://doi.org/10.1088/1748-9326/ab28bb; Sterman, J. et al. "Does wood bioenergy help or harm the climate?" *Bulletin of the Atomic Scientists* (2022) 78(3): 128–138. https://doi.org/10.1080/00963402.2022.2062933.

[205] Hudiburg, T.W. et al. "Meeting GHG reduction targets requires accounting for all forest sector emissions." *Environmental Research Letters* (2019) 14: 095005. https://doi.org/10.1748-9326/ab28bb.

[206] *Id;* Harmon, M.E. et al. "Modeling carbon stores in Oregon and Washington forest products: 1900–1992." *Climatic Change* (1996) 33: 521–550. https://doi.org/10.1007/BF00141703; Law, B.E. et al. "Land use strategies to mitigate climate change in carbon dense temperate forests." *Proceedings of the National Academy of Sciences of the United States of America* (2018) 115(14): 3663–3668. https://doi.org/10.1073/pnas.1720064115.

[207] *Understanding Global Warming Potentials*, U.S. Environmental Protection Agency, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (updated Aug. 8, 2024).

[208] Harmon, M.E. et al. "Modeling carbon stores in Oregon and Washington forest products: 1900–1992." *Climatic Change* (1996) 33: 521–550. https://doi.org/10.1007/BF00141703.

[209] Hudiburg, T.W. et al. "Meeting GHG reduction targets requires accounting for all forest sector emissions." *Environmental Research Letters* (2019) 14: 095005. https://doi.org/10.1748-9326/ab28bb.

[210] *Id.*

[211] Law, B.E. and M.E. Harmon. "Forest sector carbon management, measurement and verification, and discussion of policy related to climate change." *Carbon Management* (2011) 2(1): 73–84. https://doi.org/10.4155/cmt.10.40.

Old-growth trees and forests contribute several key characteristics to watersheds. Important contributors to overall watershed function include landscape connectivity, ecosystem components that regulate sedimentation and interface with groundwater, complex river structures, and riparian wetlands/vegetation.[212] The presence of old forests—and especially the old trees that are a necessary component of such forests—enhances these characteristics.

Forests generally circulate precipitation via uptake of water from roots to canopies and release water back to the atmosphere by evapotranspiration through leaf pores. This function of trees increases as they get older and larger because leaf area—which is greater in larger trees—is related to site water balance, soil water storage/retention, and better water retention in trees.[213]

Individual old-growth trees are a vital component of the overall old-growth forest structure that contributes to watershed integrity. Their deep root systems help maintain soil structures and allow for infiltration and interfacing between the surface and groundwater.[214] Particularly when compared to younger forests, the infiltration afforded by old-growth trees significantly reduces stormwater runoff, increases the water storage capacity of the system, and helps buffer against flooding and drought.[215]

Older trees can also directly benefit waterways. When old growth grows alongside rivers, dense riparian vegetation can help promote bank stability and intercept runoff before it reaches the stream—thereby minimizing sedimentation and other pollutant inputs to the waterbody.[216] Even after sediment enters a stream, healthy riparian wetlands and floodplains are critical for sediment removal and deposition, contributing to higher water quality and overall stream function.[217] Their canopy cover provides significant shade, keeping maximum temperatures down, and minimizing the frequency and duration of elevated temperatures within the stream.[218] This is particularly important for fishes and amphibians who are adapted to cooler waters.[219]

The hydrological importance of intact mature and old-growth forests also extends underground due to mycorrhizae support found in many species. Numerous studies have revealed that soil biota, particularly fungi that form symbioses with plant roots (mycorrhizae), provide a suite of ecosystem services that support the integrity and resiliency of natural and human communities.[220] Mycorrhizae are known to reduce erosion and

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212 U.S. Environmental Protection Agency. "Identifying and Protecting Healthy Watersheds: Concepts, Assessments, and Management Approaches." (2012) EPA 841-B-11-002. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100NAYB.PDF?Dockey=P100NAYB.PDF.

213 Grier, C.G. and S.W. Running. "Leaf area of mature northwestern coniferous forests: relation to site water balance." *Ecology* (1977) 58(4): 893–899. https://doi.org/10.2307/1936225; Jiang, Y. et al. "Linking tree physiological constraints with predictions of carbon and water fluxes at an old-growth coniferous forest." *Ecosphere* (2019) 10(4): e02692. https://doi.org/10.1002/ecs2.2692.

214 Humann, M. et al. "Identification of runoff processes - The impact of different forest types and soil properties on runoff formation and floods." *Journal of Hydrology* (2011). 409(3–4): 637–649. https://doi.org/10.1016/j.jhydrol.2011.08.067.

215 *Id.*

216 *Id.*

217 Erdozain, M. et al. "Forest management impacts on stream integrity at varying intensities and spatial scales: Do abiotic effects accumulate spatially?" *Science of The Total Environment* (2021) 753: 141968. https://doi.org/10.1016/j.scitotenv.2020.141968.

218 Roon, D.A. et al. "Shade, light, and stream temperature responses to riparian thinning in second-growth redwood forests of northern California." *PLoS ONE* (2021) 16(2): e0246822. https://doi.org/10.1371/journal.pone.0246822.

219 *Id.*

220 Markovchick, L.M. et al. "The gap between mycorrhizal science and application: existence, origins, and relevance during the United Nation's Decade on Ecosystem Restoration." *Restoration Ecology* (2023) 31(4): e13866. https://doi.org/10.1111/rec.13866.

nutrient loss,[221] increase plant water use efficiency and retention,[222] and help plants adapt to changes in climate.[223]

The larger, older trees within old-growth forests continue to provide watershed benefits even after they die. Large woody debris (LWD) create hydraulic diversity within streams by causing water to slow and pool in some places and rush and eddy in others.[224] Old-growth forests often contribute larger quantities of LWD compared to younger forests, which is positively correlated with pool frequency and density.[225] This variation increases habitat complexity, providing breeding and feeding habitat for fish and hunting grounds for predators.[226] LWD can also serve as a physical obstacle along the river network to encourage particle dropout and minimize sediment transport further downstream.[227]

In contrast, timber harvest is a known detriment to water quality. The roads and infrastructure related to harvest alter the hydrological process by intercepting rainfall directly on the road's largely impermeable surface, concentrating the flow of water, and diverting water from where it would have otherwise ended up.[228] Indeed, the watershed impact of the active management still allowed within old-growth stands are compounded by the negative impacts of the roadbuilding needed to access such often-remote forests.[229] Logging can also lead to an influx of sediment and nutrients, as well as a greater and faster influx of rainwater to streams.[230] And the heavy machinery needed for logging projects can further reduce soil stability, leading to compaction and erosion in varying degrees across the affected landscape.[231] Further, roads disrupt landscape connectivity and contribute to habitat fragmentation.[232] Roadless areas are a refuge from such perturbations,

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221 Mardhiah, U. et al. "Arbuscular mycorrhizal fungal hyphae reduce soil erosion by surface water flow in a greenhouse experiment." *Applied Soil Ecology* (2016) 99: 137–140. https://doi.org/10.1016/j.apsoil.2015.11.027.

222 Querejeta, J.I. et al. "Differential modulation of host plant δ13C and δ18O by native and nonnative arbuscular mycorrhizal fungi in a semiarid environment." *New Phytologist* (2005) 169(2): 379–387. https://doi.org/10.1111/j.1469-8137.2005.01599.x; Gehring, C.A. et al. "Tree genetics defines fungal partner communities that may confer drought tolerance." *Proceedings of the National Academy of Sciences* (2017) 114(42): 11169–11174. https://doi.org/10.1073/pnas.1704022114; Wu, Q.-S. and R.-X. Xia. "Arbuscular mycorrhizal fungi influence growth, osmotic adjustment and photosynthesis of citrus under well-watered and water stress conditions." *Journal of Plant Physiology* (2006) 163(4): 417–425. https://doi.org/10.1016/j.jplph.2005.04.024.

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

224 Gippel, C.J. "Environmental Hydraulics of Large Woody Debris in Streams and Rivers." *Journal of Environmental Engineering* (1995). 121(5), 388. https://doi.org/10.1061/(ASCE)0733-9372(1995)121:5(388).

225 Keeton, W.S. et al. "Mature and old-growth riparian forests: Structure, dynamics, and effects on Adirondack stream habitats." *Ecological Applications* (2007). 17(3): 852–868. https://doi.org/10.1890/06-1172.

226 Gippel, C.J. "Environmental Hydraulics of Large Woody Debris in Streams and Rivers." *Journal of Environmental Engineering* (1995). 121(5), 388. https://doi.org/10.1061/(ASCE)0733-9372(1995)121:5(388); Keeton, W.S. et al. "Mature and old-growth riparian forests: Structure, dynamics, and effects on Adirondack stream habitats." *Ecological Applications* (2007). 17(3): 852–868. https://doi.org/10.1890/06-1172.

227 Erdozain, M. et al. "Forest management impacts on stream integrity at varying intensities and spatial scales: Do abiotic effects accumulate spatially?" *Science of The Total Environment* (2021). 753, 141968. https://doi.org/10.1016/j.scitotenv.2020.141968.

228 Gucinski, H. et al. "Forest roads: a synthesis of scientific information." *USDA Forest Service* Gen. Tech. Rep. PNW-GTR-509. Pacific Northwest Research Station, Portland, OR (2001). https://doi.org/10.2737/PNW-GTR-509.

229 Endicott, D. "National level assessment of water quality impairments related to forest roads and their prevention by best management practices." Environmental Protection Agency Great Lakes Environmental Center Office of Water, Traverse City, MI (2008). https://www.regulations.gov/document/EPA-HQ-OW-2015-0668-0005.

230 Erdozain, M. et al. "Forest management impacts on stream integrity at varying intensities and spatial scales: Do abiotic effects accumulate spatially?" *Science of The Total Environment* (2021). 753, 141968. https://doi.org/10.1016/j.scitotenv.2020.141968.

231 *Id.*

232 Gucinski, H. et al. "Forest roads: a synthesis of scientific information." *USDA Forest Service* Gen. Tech. Rep. PNW-GTR-509. Pacific Northwest Research Station, Portland, OR (2001). https://doi.org/10.2737/PNW-GTR-509.

allowing these minimally disturbed forests to protect the headwaters of critical drinking water sources and watersheds at large.[233]

The DEIS squarely recognizes the benefits of old growth to watersheds and the deleterious impacts of logging. It discloses that many Land Management Plans afford special protections to riparian areas, including "the PACFISH and INFISH amendments prohibit commercial timber harvest in riparian habitat conservation areas (RHCAs)"[234] (though numerous forest plans revisions have failed to retain the PACFISH/INFISH amendments). And the DEIS directly recognizes the importance of old growth to watershed integrity: "Undisturbed forest, which is a common condition in old growth, often has the highest water quality (Fredriksen, 1971) since old-growth forests are highly retentive of nutrients in both living biomass and dead organic material."[235]

Protecting old-growth trees and minimizing the negative impacts of proactive management on old-growth forests will be important to help protect watersheds in the age of climate change. Where anthropogenic stressors can be minimized, forests will have fewer perturbations to contend with, giving them a better chance at resisting or recovering from climate driven disturbances. This will better allow these systems to continue providing the societal resources we demand from our watersheds, including clean drinking water and healthy aquatic habitats.

iii. Old-growth trees and stands provide essential habitat for a range of species.

Old-growth trees and forests provide irreplaceable habitat for wildlife. The DEIAR readily acknowledges this, stating "[o]ld-growth forests support high levels of biodiversity due to complex structure, with features like large trees, diverse understory vegetation, and abundant dead wood creating a wide range of ecological niches and microhabitats."[236] As forests age over decades and centuries, they form complex ecosystems with vibrant old trees at their foundation.

Left undisturbed, conditions such as shade from canopy closure and reduced temperatures due to evapotranspiration nurture a variety of plants and provide climate refugia to wildlife that would often struggle to survive elsewhere.[237] The DEIAR also highlights that old-growth forests have the time to develop unique habitat characteristics not found in younger forests, including a higher number of tree cavities, complex lichen assemblages, and diverse fungal communities which contribute to nutrient cycling and uptake.[238] Natural disturbance events are key to fostering such diversity by creating a mosaic landscape with live and dead trees across age classes. Older forests have a variety of dead trees that provide habitat, including standing logs (snags)—which are important habitat elements for numerous woodpeckers, owls, and rodents—and fallen large logs (coarse woody debris)—which provide food foraging for bears, habitat and cover for imperiled marten and other rodents, and essential nutrients for new vegetation and tree saplings.[239]

As a result of these and other features, old-growth forests serve as irreplaceable regional climate refugia for a wide variety of threatened, endangered, and sensitive species. In the U.S. examples include:

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[233] DellaSala, D.A. et al. "Roadless areas and clean water." *Journal of Soil and Water Conservation* (2011) 66(3): 78A–84A. https://doi.org/10.2489/jswc.66.3.78A.
[234] DEIS at 80.
[235] *Id*. at 12.
[236] DEIAR at 11.
[237] Grier, C.G. and S.W. Running. "Leaf Area of Mature Northwestern Coniferous Forests: Relation to Site Water Balance." *Ecology* (1977) 58(4): 893–899. https://doi.org/10.2307/1936225; Nagy, R.C., et al. "Water resources and land use and cover in a humid region: the southeastern United States." *J. Environmental Quality* (2011) 40(3): 867–878. https://doi.org/10.2134/jeq2010.0365.
[238] DEIAR at 11.
[239] Johnson, D.L., et al. "Ecological Forest Management," *Waveland Press* (2018). Perry, D.A. "Forest ecosystems." *JHU Press* (1994).

- Spotted owl (northern and Mexican subspecies listed as threatened): Spotted owls need mature and old-growth forests for nesting and roosting, and, in the Pacific Northwest, for withstanding invasive barred owl population growth. When older forests are logged, including by reducing canopy levels via thinning and fuel reduction treatments, northern spotted owls are forced to compete with barred owls.[240] Additionally, studies have found that any reduction in canopy cover by logging harms spotted owls by negatively impacting site occupancy, reproduction, and survival.[241] These impacts from logging can be dramatic within just a few years. Indeed, based on modeling studies, the rate of old forest loss from proposed thinning in the northern spotted owl recovery plan exceeds the anticipated loss of nesting and roosting habitat from fires over a 40-year period, even with climate change in the model.[242]

- Marbled murrelet (federally listed as threatened): This is a seabird that nests in old-growth forests found along the Pacific coast. Logging these forests fragments nesting areas, which then results in elevated nest predation by corvids.[243]

- Kaibab squirrel (Arizona-state listed as imperiled and vulnerable): This is an endemic and rare subspecies of tassel-eared squirrel found only on Arizona's Kaibab Plateau. It depends on the structure and complex interactions of old-growth forests to facilitate its movements and provide food.[244]

- Canada lynx (federally listed as threatened): This elusive cat species depends on complex, multistory forests for denning habitat and to find its main prey species: snowshoe hares. This type of high-quality denning habitat is limited to mature forest, which provides the coarse woody debris needed for thermal cover and protection for the lynx's young.

- Fisher (federally listed as sensitive): This is a medium mustelid that can be found in the northern Rockies, primarily Montana and Idaho. Research shows that fishers are associated with older forests throughout their range.[245] Fishers need dense overhead cover, abundant coarse woody debris, and large trees.[246] Female fishers use cavities in large-diameter live trees and snags because tree cavities

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

241 Stephens, S.L. et al. "California Spotted Owl, songbird, and small mammal responses to landscape fuel treatments." *BioScience* (2014) 64(10): 893–906. https://doi.org/10.1093/biosci/biu137; Tempel, D.J. et al. "Meta-analysis of California Spotted Owl (*Strix occidentalis occidentalis*) territory occupancy in the Sierra Nevada: Habitat associations and their implications for forest management." *The Condor* (2016) 118(4): 747–765. https://doi.org/10.1650/CONDOR-16-66.1.

242 Odion, D.C. et al. "Effects of fire and commercial thinning on future habitat of the Northern Spotted Owl." *The Open Ecology Journal* (2014) 7: 37–51. http://dx.doi.org/10.2174/1874213001407010037.

243 Malt, J.M. and D.B. Lank. "Marbled Murrelet nest predation risk in managed forest landscapes: dynamic fragmentation effects at multiple scales." *Ecological Applications* (2009) 19(5): 1274–1287. https://doi.org/10.1890/08-0598.1.

244 Dodd, N.L. et al. "Tassel-Eared Squirrel population, habitat condition, and dietary relationships in North-Central Arizona." *Journal of Wildlife Management* (2003) 67(3): 622–633. https://doi.org/10.2307/3802719; Loberger, C.D. et al. "Use of restoration-treated ponderosa pine forest by tassel-eared squirrels." *Journal of Mammalogy* (2011) 92(5): 1021–1027. https://doi.org/10.1644/10-MAMM-A-321.1.

245 Aubry, K.B. et al. "Meta-Analysis of habitat selection by fishers at resting sites in the pacific coastal region." *The Journal of Wildlife Management* (2013) 77(5): 965–974. http://dx.doi.org/10.1002/jwmg.563; Olson, L.E. et al. "Modeling the effects of dispersal and patch size on predicted fisher (*Pekania* [*Martes*] *pennanti*) distribution in the U.S. Rocky Mountains." *Biological Conservation* (2014) 169: 89–98. https://doi.org/10.1016/j.biocon.2013.10.022; Sauder, J.D. and J.L. Rachlow. "Both forest composition and configuration influence landscape-scale habitat selection by fishers (*Pekania pennanti*) in mixed coniferous forests of the Northern Rocky Mountains." *Forest Ecology and Management* (2014) 314: 75–84. http://dx.doi.org/10.1016/j.foreco.2013.11.029.

246 *Id.*

regulate temperatures and protect kits from predators.[247] Forest configuration figures just as much into the type of habitat that fisher need as composition, specifically the proximity of mature forest patches. Researchers found that fishers in Idaho's Clearwater Basin used landscapes with large patches of mature forest arranged in connected patterns.[248]

- Pacific (formerly American or Pine) marten (coastal distinct population in northwest California and southwest Oregon federally listed as threatened; Vermont-state listed as endangered): The marten is a mustelid species that has been eliminated from much of its historic range. According to the Fish and Wildlife Service, "[m]artens across North America generally select older forest stands that are structurally complex (e.g., late-successional, old-growth, large-conifer, mature, late-seral). These forests generally have a mixture of old and large trees, multiple canopy layers, snags and other decay elements, dense understory, and have a biologically complex structure and composition."[249] As mature and old-growth forests are lost, martens decline. A 2022 study analyzing marten populations in Maine found that "even partial harvest activities can diminish the canopy cover, structural complexity and overall basal area [that marten] require."[250] The same study found that "Marten…showed lower initial occupancy probability in areas of increasingly disturbed forest and had both higher extinction rates and lower colonization rates in these areas."[251]

- Northern long-eared bat (federally listed as threatened, proposed for uplisting to endangered): The bat depends on mature and old forests for roosting and foraging.[252] Its preferred roosting habitat is large-diameter live or dead trees of a variety of species, with exfoliating bark, cavities, or crevices. And its preferred foraging habitat is old forest with complex vertical structure on hillsides and ridges.[253]

Continued logging of old-growth trees and forests damages these essential foundations for biodiversity. While younger forests can provide specific habitat for many species, they are not a rarity in most of the country. Old-growth forests are. The DEIAR recognizes that, "maintaining a mosaic of old-growth forests and forests of different ages (stages in forest development) and seral stages is crucial for preserving a broad spectrum of plant and animal communities and associated ecological integrity across broad areas."[254] Given the rarity of old forests, ensuring that what remains stays intact is a critical piece of maintaining this broader mosaic. The development of early seral forest structures via logging for habitat or biodiversity purposes should never include old-growth trees as such actions only serve to eliminate rare and needed habitat.

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[247] *Id.*

[248] Sauder, J.D. and J.L. Rachlow. "Both forest composition and configuration influence landscape-scale habitat selection by fishers (*Pekania pennanti*) in mixed conifer forests of the Northern Rocky Mountains." *Forest Ecology and Management* (2014) 314: 75–84. http://dx.doi.org/10.1016/j.foreco.2013.11.029.

[249] U.S. Fish & Wildlife Service. "Designation of Critical Habitat for the Coastal Distinct Population Segment of the Pacific Marten." 86 *Fed. Reg.* 58,831, 58,833 (Oct. 25, 2021). https://www.federalregister.gov/documents/2021/10/25/2021-22994/endangered-and-threatened-wildlife-and-plants-designation-of-critical-habitat-for-the-coastal.

[250] Evans, B.E. and A. Mortelliti, "Effects of forest disturbance, snow depth, and intraguild dynamics on American marten and fisher occupancy in Maine, USA." *Ecosphere* (2022) 13(4): e4027. https://doi.org/10.1002/ecs2.4027.

[251] *Id.*

[252] Burkhart, J. et al. "Species Status Assessment Report for the Northern long-eared bat (*Myotis septentrionalis*)." *U.S. Fish and Wildlife Service* (2022) Version 1.1. https://www.fws.gov/sites/default/files/documents/Species%20Status%20Assessment%20Report%20for%20the%20Northern%20long-eared%20bat-%20Version%201.1%20%282%29.pdf.

[253] *Id.*

[254] DEIAR at 12.

IV. Key Additional Issues to Ensure Effective Implementation[255]

A. Metrics for distribution and abundance

The proposed policy does not ensure that total old-growth acreage is tracked or that old-growth expansion is treated as a key indicator of successful implementation including a metric for expansion goals. The agency must correct this by developing metrics to assess old-growth recruitment and expansion. Such metrics include:

- Acres of old growth by National Forest;
- The presence, abundance and distribution of old-growth dependent species as verified by population trend monitoring;
- Old growth habitat connectivity between old-growth stands; and
- Progress towards amounts and distributions of old growth within the natural range of variation.

The NOGA relies on structural metrics for old growth definition, identification, and inventory. Although these definitions can be useful for identifying old growth for purposes of applying standards, they are not necessarily useful for assessing whether old growth is expanding in abundance and distribution. Among other things, the definitions do not clearly integrate indicators of ecological integrity, including connectivity and the presence of species associated with old growth. And because the definitions of old growth are narrow and highly prescriptive, it is not clear how the agency will track expansion.

A first step towards tracking and ensuring progress towards "improving and expanding [the] abundance and distribution" of old-growth is to measure acreage of old-growth by National Forest, year over year. DEIAR Appendix 2 is a coarse baseline that establishes the expanse and broad-scale distribution of old growth (by thousands of acres per National Forest System unit) at the time of this DEIS comment period. A tracking mechanism would, at a minimum, provide annual reports on increases and decreases in old growth acreage by National Forest System unit, building on the aforementioned table in DEIAR Appendix 2.

Second, as a way to provide public transparency and to assist with agency planning, the Forest Service must also produce a stand-scale map that corresponds with DEIAR Appendix 2, in contrast with the very coarse scale fireshed mature and old growth "heatmap" that was produced for the Mature and Old Growth Inventory. Such a stand-scale map is essential for understanding the fine-scale distribution of old-growth stands to ensure informed decision-making at the planning and project levels.

Tracking overall old-growth acreage and stand-scale distribution are important first steps for accountability, but more is needed. The agency must develop metrics focused on ecosystem composition, structure, function, and connectivity, consistent with the call of the 2012 Planning Rule. In particular, the agency must focus on developing metrics that pertain to the presence, viability, and population trends of old-growth dependent species and the connectivity of old-growth habitat at scales that are sufficient to sustain old-growth species and assemblages. To use an extreme example, a single, isolated stand of old growth on the edge of a suburb, or in an area with a dense network of logging roads and extensive recent logging history, may meet the structure-based definition of old growth and contribute to the overall acreage of old growth within a National Forest, but this isolated stand will have much different habitat values than an old-growth stand within a larger matrix of contiguous forest. Without metrics that account for indicator species and connectivity, the agency risks reducing old growth to little more than a set of structural characteristics, rather than a unique and complex ecosystem.

[255] Appendix D includes additional recommendations for developing ecologically oriented management targets and more sophisticated metrics for tracking carbon and greenhouse gas emissions.

Finally, the agency should develop metrics of progress towards attaining the high end of the natural range of variation of old growth as a percentage target for each forest type within a given National Forest.[256] These metrics should take into account, among other things, the unique role of National Forest System lands in the broader context of public and private forestlands and the amount and distribution of old growth across all ownerships.

B. Developing inclusive old growth definitions

The agency must use definitions of "old-growth forest" that do not undermine the purpose and need of "maintaining and developing old-growth forests while improving and expanding their abundance and distribution."[257] NOGA Standard 1 requires using existing forest plan definitions, or regional definitions when no forest plan definition applies. But Standard 1 would leave many forests with definitions that are a poor fit for the NOGA and would do little to protect old growth. And the regional definitions may be underinclusive—the regional definitions based on FIA data may omit areas of old growth where a stand-level exam would identify it as old growth.

Some forest plans define old growth so narrowly that virtually nothing in those forests would be protected by the standards in the NOGA. Others define old growth such that it would be virtually impossible to recruit new old growth. For example, the White Mountain National Forest plan defines old growth in part as "an abundance of trees at least 200 years old . . . . There should be little or no evidence of past timber harvest or agriculture."[258] Not only does this definition set an age threshold well beyond when many forests in this region should qualify as old growth,[259] but the definition essentially defines old growth as primary forest, making it virtually impossible for any previously logged area to be recruited as old growth. Even "proactive stewardship" that the agency claims would promote old growth would leave evidence of timber harvest, facially disqualifying a forest from meeting the definition of old growth. (For the few areas that meet the narrow definition of old-growth forest, the forest plan does—and will continue to—prohibit timber harvest.[260])

For the neighboring Green Mountain National Forest, the definition is so vague that the NOGA's application is indecipherable. The plan defines old-growth forest as a "patch of relative old forest of at least 5 to 10 acres . . . . Such old-growth stands exhibit a long history of continuity and a demonstrated future via replacement dynamics."[261] This nebulous definition will make it difficult, if not impossible, to assess compliance with the NOGA.

Meanwhile, several forest plans, in the guise of defining "old growth," resist defining the term at all. The Chequamegon-Nicolet National Forests plan commendably includes a management area for some old-growth stands but only describes how old growth "varies with species and site."[262] There is no definition of old-growth trees and the definition of old-growth forests is functionally useless.

Where regional definitions apply, they would suffer from a different set of defects. The definitions were developed by the agency in the early 1990s, in response to then USFS Chief Dale Robertson's 1989 letter,

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[256] Hayward, G.D. et al 2016, "Applying the 2012 Planning Rule to Conserve Species: A Practitioner's Reference." Unpublished paper, USDA Forest Service, Washington, D.C., USA. https://www.fs.usda.gov/naturalresources/documents/SCCPractitionersRefApplying2012PlngRuleToCnsrvSpcs.pdf.
[257] DEIS at 7.
[258] USDA Forest Service, White Mountain National Forest – Land and Resource Management Plan, at Glossary 21 (Sept. 2005).
[259] For comparison, the agency's corresponding regional definitions of old growth require that stands be between 101 and 161 years old, depending on the species. *See* Mature and Old Growth Inventory, Appendix 1, at 52 tbl. 17 (rev. Apr. 2024).
[260] USDA Forest Service, White Mountain National Forest – Land and Resource Management Plan 2–13 (Sept 2005).
[261] USDA Forest Service, Green Mountain National Forest, Land and Resource Management Plan 140 (Feb. 2006).
[262] USDA Forest Service, Chequamegon-Nicolet National Forests, 2004 Land and Resource Management Plan Appendix EE, at 8 (Apr. 2004).

with some definitions being refined over time according to the agency. The Chief's letter was in response to nationwide public alarm about the massive liquidation of old-growth forests, generally by clearcutting them and replacing them with monoculture plantations. At the time, the agency was significantly focused on logging and generated about 12 billion board feet per year from the 1960s-1990s, including from numerous old-growth trees and forests. Given these cross-pressures, the definitions that were developed are often overly narrow and result in excluding old growth that should properly be classified as such. That is, the definitions were developed to minimize protections for old growth and thus cannot serve as the foundation of a policy to expand the abundance and distribution of the same.

Upon finalizing the NOGA, the agency should direct forest units to assess which old growth definitions apply within their jurisdictions and—importantly—develop new, inclusive old growth definitions where existing definitions are so limiting that they would not advance the NOGA's purpose and need. Forest units should conduct this exercise as soon as possible and no later than the next time their forest plans are amended or revised.

We have previously advocated for a single, nationwide definition for defining mature trees, as well as definitions of old growth that would cover all forests within the eastern and western halves of the country. We continue to believe that streamlined, broadly applicable definitions are preferable for their efficiency, clarity, and ease of administration. However, in the preceding paragraphs, we have endeavored to offer recommendations tailored to the agency's approach in the DEIS.

C. REPORT ON INFLATION REDUCTION ACT FUNDING

Following the record of decision, the agency should produce a report with a detailed accounting of how the $50 million appropriated by Congress "for the protection of old-growth forests" was or is being spent.[263]

V. Mature Forests

While the agency can course correct on old growth, the failure to protect mature forests will still fall short of the DEIS's purpose and need and the direction in section 2 of E.O. 14072. None of the alternatives contain standards that protect mature trees and forests. The guidelines that touch on recruitment do not even set recruitment targets or incorporate accountability mechanisms, let alone compel any degree of protection for mature forests. And the adaptive strategies devolve future mature forest policy to a series of local decision-making processes subject to the same pressures that currently incentivize logging. Given this, the agency must ensure that nothing in the final policy impedes the swift development of a meaningful mature forest and tree policy, as laid out below.

To create an opportunity for action that would meet E.O. 14072 and match the intent expressed in the purpose and need, the Forest Service must swiftly move to develop a policy with meaningful standards that protect mature forests. Such a policy would advance the purpose of the action identified in the DEIS to maintain and develop old-growth conditions and to improve and expand their abundance and distribution across the National Forest System. The agency has repeatedly recognized the important role mature and old-growth forests play in contributing to nature-based climate solutions by storing large amounts of carbon, increasing biodiversity, and mitigating wildfire risks—and that prior logging has contributed to loss of old-growth forest.[264]

Any such policy should feature several key mechanisms:

- Establish substantive and immediately effective nationwide protective standards;
- Ensure the protection of the robust baseline of mature trees and forests across the National Forest System;
- Include simple-to-administer limits on logging;

[263] Inflation Reduction Act, Pub. L. No. 117-169, § 23001(a)(4), 136 Stat. 1818, 2023 (2022).
[264] NOI, 88 Fed. Reg. at 88,043.

- Provide for appropriate management of impaired ecosystems in dry forests, such as for damaging wildfire; and
- Curtail commercial exchange of mature trees.

Implementing natural climate solutions across all forest ownerships in the U.S. could mitigate up to 424 million tonnes of CO_2 equivalent per year by 2030.[265] Mature and old-growth forests and trees represent an essential subset of these forests due to their carbon storage and carbon sequestration values. As noted above, protecting the substantial bulk of standing carbon in mature forests would also deliver significant co-benefits, including for ecological function, biodiversity protection, and hydrological functions.[266] If the United States is to assert global leadership in fighting the climate crisis, it must protect the essential carbon-rich values present in mature forests and trees.

Importantly, protecting mature forests from ecologically damaging logging will not impede appropriate wildfire mitigation work. As noted, older, larger trees are not the primary contributors to fire risk—they have often developed characteristics that make them more resistant to wildfires, such as thicker bark and higher branches.[267] A policy protecting mature forests could still permit the cutting and removal of smaller and younger trees, which act as the surface and ladder fuels that are significant contributors to damaging forest fires.

Developing durable standards that protect mature trees and forests will finish the necessary work recognized by the DEIS's purpose and need statement, provide essential guardrails on any locally developed policies aimed at mature forests, and provide a mechanism that fully meets the direction provided in section 2 of E.O. 14072.

Sincerely,

350 Eugene
350 Seattle
Cascadia Wildlands
Center for Biological Diversity
Chattooga Conservancy
Citizens for a Clean Harbor
Coalition to Protect America's National Parks
Earthjustice
Environment America Research and Policy Center
Environmental Law and Policy Center
Forest Keeper
Forests Forever
Friends of Blackwater, Inc.
Friends of White's Woods
Gallatin Wildlife Association

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[265] Griscom, B. W. et al. "Natural Climate Solutions." *Proceedings of the National Academy of Sciences* (2017) 114(44): 11645–11650. https://doi.org/10.1073/pnas.1710465114.
[266] *See, e.g.*, Aron, P.G. et al. "Stable water isotopes reveal effects of intermediate disturbance and canopy structure on forest water cycling." *Journal of Geophysical Research* (2019) 124(10): 2958–2975. https://doi.org/10.1029/2019JG005118; Perry, T.D. and J.A. Jones. "Summer streamflow deficits from regenerating Douglas-fir forest in the Pacific Northwest, USA." *Ecohydrology* (2017) 10(2): 1790. https://doi.org/10.1002/eco.1790; Perry, D.A. "Forest Ecosystems." *Johns Hopkins University Press* (1994); Dinerstein, E. et al. "A 'Global Safety Net' to reverse biodiversity loss and stabilize Earth's climate." *Science Advances* (2020) 6(36): eabb2824. https://doi.org/10.1126/sciadv.abb2824; Jung, M. et al. "Areas of global importance for conserving terrestrial biodiversity, carbon and water." *Nature Ecology and Evolution* (2021) 5: 1499–1509. https://doi.org/10.1038/s41559-021-01528-7.
[267] *See supra* III.A.ii.1.a.

Kentucky Heartwood
Natural Resources Defense Council
Old-Growth Forest Network
Oregon Wild
Sierra Club
Soda Mountain Wilderness Council
Speak For The Trees Too
Standing Trees
The Larch Company
The Norbeck Society
WildEarth Guardians
Women's Earth and Climate Action Network (WECAN)
Yaak Valley Forest Council

Appendix A

Climate Change Comments on the US Forest Service's (USFS) Draft Environmental Impact Statement for its proposed Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System

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September 15, 2024

1. The Urgency of the Climate Crisis

The DEIS's climate analysis generally does not recognize the disproportionate importance of this decade and the next for meeting critical climate goals and avoiding the worst consequences of climate change (Friedlingstein et al., 2023). Climate science has shown that we are in a pivotal period when future outcomes of massive consequence to society and future generations will be determined (IPCC, 2023; Ripple et al., 2023). Executive Order 14072 was motivated in large part by the urgency of taking integrated climate action and the importance of mature and old forests as a natural climate solution (Birdsey et al., 2023; Lutz et al., 2018). In response to the December 20, 2023 Notice of Intent for a National Old Growth Amendment in the Federal Register, 195 scientists with backgrounds in forest ecosystems, climate change, and natural resources wrote: "**Logging and associated road building in mature and old-growth forests and the removal of large trees on federal lands is the main form of forest degradation and is therefore inconsistent with your global commitments and relevant executive orders**." Yet the DEIS looks to the symptoms of climate change to rationalize a proposed action that unjustifiably retains broad discretion to log both old-growth trees and infrequent-fire old-growth stands under the guise of proactive stewardship. But reducing emissions to the atmosphere that cause climate change requires protecting accumulated carbon stocks in old forests, and limited intervention in them, focused on cutting small young trees in frequent-fire old-growth forests or introducing prescribed fire to restore a low-severity fire regime. As it stands, the proposed action threatens greater carbon emissions during the rapidly closing window of time for meeting climate goals by reducing emissions. This is a critical shortcoming of the DEIS because it is through the lens of climate science that the long-term implications of these proposed policy changes should be considered.

The urgency of the climate crisis and the importance of protecting intact natural ecosystems is made clear in the 2023 IPCC Report:

> There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all.
>
> The choices and actions implemented in this decade will have impacts now and for thousands of years.
>
> Maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% to 50% of Earth's land, freshwater and ocean areas, including currently near natural ecosystems.

2. The Global Carbon Budget

The remaining carbon budget for a 50% likelihood to limit global warming to 1.5, 1.7, and 2°C has reduced to 75 Gt C (275 Gt CO_2), 175 Gt C (625 Gt CO_2), and 315 Gt C (1150 Gt CO_2), respectively, from the beginning of 2024, **equivalent to around 7, 15, and 28 years, assuming 2023 emission levels** (Friedlingstein et al., 2023). In other words, we are perilously close to running out of time before we overshoot the 1.5°C threshold.

Our ability to limit the overshoot time period and keep global warming below the 1.5°C threshold (in the long run) is no longer possible only by phasing out fossil fuels. As the 2023 IPCC Report recognizes, we need to keep 50% of Earth's land and waters intact to support natural processes needed to mitigate the climate crisis.

3. Climate-related Research Strongly Supports Retaining Old-Growth Trees

a. Forests are an essential carbon sink.

The accumulation of carbon in forest ecosystems is essential for keeping carbon dioxide out of the atmosphere (IPCC, 2018; 2023) and mitigating ongoing climatic change (Pan et al., 2024). Forests account for 92% of all terrestrial biomass globally (Pan et al., 2013) and their removal of about 30% of fossil fuel emissions annually from the atmosphere has been fairly constant for about the last 60 years, with a significant portion taken up by temperate forests (Friedlingstein et al., 2023). Moreover, forests provide critical habitats to more than half of all known plant and animal species on Earth (FAO, 2020).

The world's forests have consistently accumulated carbon over the past three decades, despite changes in the buffering capacity of different biomes, such as in the Amazon rainforest due to deforestation and forest degradation (Friedlingstein et al., 2023; Pan et al., 2024). On the topic of forest carbon status and dynamics, the DEIS cites to intensification of the hydrologic cycle driving productivity responses to climate change (Hogan et al., 2024), increasing drought- and heat stress-induced declines in some tree species of the western US (Stanke et al., 2021), and climatically-driven changes in disturbance regimes and concurrent shifts in vegetation distribution in forests of the USA (McDowell et al., 2020). However, the global forest carbon sink has endured despite these variations in regional and continental scales (Pan et al., 2024). The carbon sink in temperate forests increased significantly, by around 30%. In some areas, such as the continental United States, temperate forests continued to accumulate carbon as middle-aged forests grew older and despite increasing emissions from disturbances, especially insects and fire (Pan et al., 2024). Pan et al. (2024) states:

> Our results indicate that the single most important action for sustaining and increasing the forest carbon sink is to stop emissions from deforestation and degradation, along with protecting the large carbon stocks that have accumulated over centuries.

In this context, old-growth forests—and old-growth trees—play an outsized role. As discussed more below, these forests and trees have large, accumulated carbon stocks and associated co-benefits to biodiversity, water, and buffering climatic extremes (Law et al., 2022; Moomaw et al., 2019).

b. There is no support for the assertion that broad authority to log old growth is needed to address climate-change induced effects to forests.

Unfortunately, rather than protecting old-growth forests to help fight climate change, the DEIS leverages climate projections to support broad discretion to log the critical components of these forests. It is understood that the effects of climate change are going to worsen in the coming decades because we have loaded the atmosphere with so much carbon dioxide, and some of these future changes will continue to affect forests (Domke et al., 2023). But for management decisions, large-scale climate projections—which are coarse resolution and contain significant uncertainties, especially about local impacts—must be considered alongside the well-documented ecological values of old forests, many of which effectively resist and buffer climatic impacts (Lindenmayer and Laurance, 2017; Lutz et al., 2018).

Old forests are among the most resilient ecosystems on Earth, with ancient trees that can live for hundreds to thousands of years, functioning as anchors of resilience and biodiversity for the entire community (Piovesan et al., 2022; Gilhen-Baker et al., 2022). Most critically, coarse-grained model projections do not consider the physiology and biophysical properties of old-growth forests that underlie their capacity to resist and buffer the effects of climate change (see Part 6 of this Appendix A). For example, physiological-based studies have found that small trees are most vulnerable during drought, not the mature trees that have reached full root, bark and canopy development and respond to climate variability better than smaller trees (Vickers et al., 2012; Irvine et al., 2004; Domec et al., 2004). Old-growth forests buffer against rising temperatures and provide cool microclimates (Frey et al., 2016) that confer advantages to some animal populations in the face of climate change (Kim et al., 2022). And old trees are particularly notable for their genetic and epigenetic life history adaptations, having survived long periods of environmental change (Piovesan et al., 2022; Cannon et al., 2022). Considering this body of research, the agency should take great care not to overemphasize risks to old-growth forests that lead to management recommendations that degrade old-growth forests and contribute to worsening climate change. The critical point is not to respond to climate change with more actions that degrade old-growth forests and contribute to increased emissions.

Contrary to this robust research, the DEIS minimizes actions that degrade forests by emphasizing the threat of climate change and downplaying the magnitude of logging. It describes cutting in old growth as a small proportion of the Forest Service's treatment footprint (DEIS at 43). However, this provides no justification for actions that degrade old-growth forests. The DEIS states that 116,460 acres of proposed vegetation management within old-growth forest were approved between December 18, 2023, and April 23, 2024. About 30,000 additional acres of treatments in old growth are under review (DEIS at 43). This is an alarming increase over the 367,000 acres of old growth that experienced tree cutting over a mean period of 9 years between 2000 and 2020. But this analysis was based on FIA plot analysis which likely underestimates the extent of old-growth logging due to the limited coverage these plots provide and the patchy distribution of old-growth forest.

It should also be noted that in forests of the conterminous US, harvesting is the largest contributor of carbon emissions by forests being some seven times greater than all other sources combined including fire, insects, land conversion, wind and disease (Harris et al., 2016). In Oregon and Washington (Region 6) about 80% of tree mortality is attributed to harvest (Berner et al., 2019). These forests could be much more effective in the fight against climate change if we protect accumulated carbon stocks in older forests and reduce harvest levels (Pan et al., 2024; Law et al., 2022).

4. Old-Growth Trees Provide Carbon Benefits Essential to Fight Climate Change.

Climate change provides no justification for logging old-growth trees—quite the opposite. Large-diameter trees that are a defining structural attribute of old-growth forests are key to the ability of forests to accumulate substantial amounts of carbon from the atmosphere and store it in long-lived tissues (Luyssaert et al., 2008; Lutz et al., 2012; Lutz et al., 2018; Leverett et al., 2021; Stephenson et al., 2014). Globally, studies have found that about half the aboveground carbon (AGC) is concentrated in a small proportion of large trees (1-5% of total stems) (Lutz et al., 2018; McNicol et al., 2018; Mildrexler et al., 2020). Large-diameter trees enhance carbon stability because they are the safest long-term storage vault for AGC in the forest (Mildrexler et al., 2023). The carbon in old and mature forests is "irrecoverable," meaning that the carbon stocks accumulated in these forests cannot be regained during the critical time to meet climate goals (Noon et al., 2022).

> "If you're trying to think of carbon as a financial investment, your junk bonds are kind of the small trees. You really want to focus your investment on gold, the Muni bonds, the big, old trees.
>
> For carbon, old-growth is a safer vault."
>
> - Malcolm North, U.S. Forest Service Research Scientist (https://tinyurl.com/tpwh9c4t)

In addition to carbon storage, large-diameter trees are also crucial for their ability to accumulate carbon from the atmosphere (Luyssaert et al., 2008; Stephenson et al., 2014; Lutz et al., 2021). Global evaluations show the rate of tree carbon accumulation increases with tree size (Stephenson et al., 2014). Stephenson et al. states:

> Here we present a global analysis of 403 tropical and temperate tree species, showing that for most species mass growth rate increases continuously with tree size. Thus, large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree.

Recognition of the importance of large-diameter trees in the global carbon cycle has led to management recommendations to conserve existing large-diameter trees and those that will soon reach large diameters (Lutz et al., 2018; Lindenmayer et al., 2014).

The DEIS avoids fully recognizing the climatic importance of retaining old-growth trees. The agency's analysis tends to place more importance on carbon gain rather than carbon stocks and makes erroneous statements such as "younger forests generally have higher rates of carbon uptake and storage" (DEIS at 14). This is wrong. Carbon storage is much higher in older forests than in young forests. Regarding rates of carbon uptake, Luyssaert et al. (2008) states:

> In fact, young forests rather than old-growth forests are very often conspicuous sources of CO_2 because the creation of new forests (whether naturally or by humans) frequently follows disturbance to soil and the previous vegetation, resulting in a decomposition rate of coarse woody debris, litter and soil organic matter (measured as heterotrophic respiration) that exceeds the NPP of the regrowth.

In old-growth forests the decisive issue is the carbon stocks. Carbon stock is carbon that is not in the atmosphere. It takes many decades to centuries for large trees to accumulate these carbon stocks from the atmosphere. This is known as the "carbon debt." Because of the urgency of reducing greenhouse gasses, incurring greater emissions now by cutting large trees so that future younger forests may accumulate carbon lost to the atmosphere from the cutting is counter-productive for reaching net- zero emissions in the next few decades. For this reason, the IPCC Report specifies that "Protection of existing natural forest ecosystems is the highest priority for reducing greenhouse gas emissions (Moomaw et al., 2019; IPCC, 2022)."

A study by Mildrexler et al. (2023) states:

> Claims that carbon stores will be "stabilized" by increasing harvest of large-diameter trees that store and accumulate the most carbon are inconsistent with basic science on thinning (Zhou et al., 2013) and the carbon cycle (Campbell et al., 2012; Law et al., 2018). These claims ignore the large amounts of CO_2 rapidly released to the atmosphere following harvest (Hudiburg et al., 2019), and that large trees cannot be replaced in short timeframes. It can take centuries to reaccumulate forest carbon stocks reduced by harvest of large trees (Birdsey et al., 2006).

Young forests store very little AGC compared to mature and old forests. And looking beyond AGC, large trees are keystone components of old-growth forest ecosystems, in which very substantial amounts of carbon are stored in coarse woody debris and soils, which are vulnerable to loss from logging operations. Harvesting large trees and converting an older forest to a younger one causes emissions that go well beyond those from loss of AGC.

These conclusions are buttressed by findings in the carbon accounting literature. Law et al. (2018) evaluated strategies to mitigate climate change in the Pacific Northwest Region. The study found that forests can store more carbon if the harvest interval is lengthened on private lands and harvest is reduced on public lands (see Figure 1 based on data from Law et al., 2018). Far less effective are reforestation—just one-third as much carbon accumulation—and lastly, afforestation—just one-tenth as much carbon accumulation—that can compete with land usage for agriculture and urban development. This finding is supported by a recent National Academy report on "Negative Emissions" or atmospheric CO_2 removal options that finds the potential for afforestation and reforestation in limiting atmospheric CO_2 to be modest.

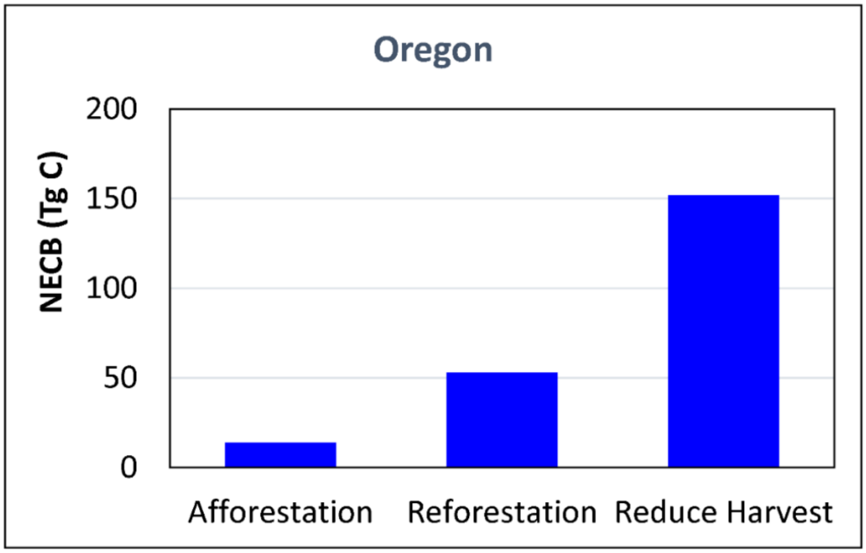

Figure 1. *Land-use strategies to mitigate climate change across Oregon. Values on y-axis are cumulative change in net ecosystem carbon balance (NECB) from 2015 to 2100. The Reduce Harvest scenario illustrates the importance of letting mature and old forests grow for climate mitigation because it maintains the carbon stores in the trees and accumulates more carbon out of the atmosphere in the near future. Data are from observation-based modeling (Law et al., 2018). Adapted from Law et al. (2022).*

While desirable, planting trees will contribute relatively little to carbon accumulation out of the atmosphere by 2100 compared to protecting natural ecosystems and reducing harvest, especially in carbon-rich forest ecosystems (Figure 1).

5. **Old-Growth Forest Extent Projected to Increase over the Next Five Decades Despite Increasing Disturbances**

The DEIS's old growth projections further undermine arguments that the agency needs to retain broad discretion to log old-growth forests. The analysis describes results from the Forest Dynamics Model projections from the 2020 Resources Planning Act (RPA) Assessment specifically for old-growth forests on National Forest System lands across the contiguous U.S. The DEIS states at 29:

> As Figure 7 shows, RPA projections show little net change in mature and old-growth forest area on Forest Service lands across the contiguous U.S. Losses from mature and old-growth due to disturbance are offset by growth and succession that transform younger forests into mature and old growth. Younger, mature, and old-growth trends from these projections were consistent with the overall forest succession and aging trends projected for all forests in the contiguous U.S. in the 2020 RPA Assessment (Coulston et al., 2023).

The DEIS also states (pg. 45):

> RPA Assessment projects old-growth forest extent to increase over each decade despite increasing disturbances, with a slowing rate of increase over each decade.

RPA projections show old-growth forest extent increasing fastest in the near future, providing evidence that the largest climate mitigation benefits from mature and old-growth forests will occur when we need them the most, in this decade and the next. The sooner these forests are protected the better.

The DEIS's analysis of Drivers and Stressors further highlights the resilience of old-growth forest in the face of climate change. For example, from 2000 to 2020, 6.8% of old-growth forest on National Forest lands experienced fire, and 50% was either low or moderate severity, with another 18% moderate-high severity. High-severity fire also plays a natural and ecologically beneficial role in forest ecosystems including creation of habitat that many plant and animal species require (Bond et al., 2012; Hutto et al., 2008; Swanson et al., 2011). For insects and disease, 22% of old-growth forest on Forest Service land was disturbed by insects and disease between 2000 and 2020. Of this area, 72% was low severity and these areas showed a net gain in old growth with overall little net loss (DEIS at 34).

Unfortunately, the proposed action does not reflect the DEIS's own analysis which supports strong protections for old-growth forest. These projections and trends indicate that old-growth forests will continue to expand in the face of disturbances and climate change. In doing so, they undermine arguments for commercial harvest in old growth, or that the key components of old growth—the large and old trees—need to be available for logging. But the DEIS does not follow on this by barring logging of these irreplaceable trees.

Instead, the DEIS infers that changing disturbances regimes and the potential future climate impacts to forests justify retaining extensive discretion to log old growth. However, literature cited in the DEIS on this topic often runs counter to this position. For example, Steel et al. (2022) is cited in reference to vulnerabilities to ecological transition and the need for active management for beneficial disturbance dynamics (DEIS at 52).

But Steel et al. (2022) simply argues for a dynamic rather than static management paradigm. Critically, they are careful to clarify that this does not involve weak protections or removing large trees. Steel et al. (2022) state:

> Moving away from a "static" conservation paradigm in favor of a "dynamic" one does not prescribe eliminating protected areas or habitat preserves; **nor would it involve removal of large trees, which our analysis shows supported forest resilience during the last decade."**

The DEIS also frequently cites to Eisenberg et al. (2024) which argues for proactive stewardship of forests emphasizing Tribal sovereignty and Indigenous Knowledge such as Indigenous fire stewardship (Hoffman et al., 2021). And there is growing support for a multi-disciplinary approach that is respectful and inclusive of all Knowledge Systems to help inform application of science so that we can mitigate and survive the climate and biodiversity crisis that we are currently in (Clark et al., 2024; Ogar et al., 2020). However, this does not include failed western forestry practices including broad discretion for logging large and old trees from old-growth forests. In fact, Eisenberg et al. (2024) defines thinning as a form of proactive stewardship to "Reduce density of small diameter trees and shift to more fire and climate resilient species composition."

Notwithstanding the clear direction of the literature—including literature that the DEIS's analysis relies heavily on—the proposed action would still allow logging of large and old-growth trees under the guise of "proactive stewardship." This startling contradiction reveals deeper systemic problems, but most importantly, it would fundamentally prevent the agency from protecting old-growth forests. Our management of these systems must minimize reductions of carbon stocks in the short-term while promoting resilience in the mid- to long-term. From a climate perspective, we simply cannot afford the costs of logging old and large trees and unwarranted mechanical intervention in infrequent-fire old-growth forests.

6. Old Forest Protection Confers Significant Co-benefits

Protecting old-growth forests is a powerful solution for confronting the twin crises of climate change and biodiversity. In any forest, the largest trees relative to the rest of the stand contribute disproportionately to ecological function such as increasing drought-tolerance, reducing flooding from intense precipitation events, altering fire behavior, redistributing soil water, and acting as focal centers of mycorrhizal communication and resource sharing networks (Bull et al., 1997; Brooks et al., 2002; Brown et al., 2004; Luyssaert et al., 2008; Beiler et al., 2015; Lindenmayer and Laurance, 2017; Teich et al. 2022). In the U.S. Pacific Northwest (PNW), carbon-dense old-growth forests buffer against increasing temperatures by creating microclimates that shelter understory species from rising temperatures (Frey et al., 2016; Davis et al., 2019). Forests with large-diameter trees tend to have high tree species richness, and a high proportion of critical habitat for endangered vertebrate species, indicating a strong potential to support biodiversity into the future and promote ecosystem resilience to climate change (Lindenmayer et al., 2014; Buotte et al., 2020). Additional co-benefits include (but are not limited to):

Water

Mature and old-growth forests are associated with increased water availability (McKinley et al., 2011; Perry and Jones, 2016; Law et al., 2018; Buotte et al., 2020). Large trees in mature and old forests act like sponges, retaining water and releasing it slowly during the summer. A Forest Service report showed that more than 136 million people nationwide rely on surface water from Forest Service lands for some of their drinking water (Ning et al., 2022). A study that prioritized the most carbon and species-rich forests in the Western US for protections found that besides safeguarding climate and biodiversity, preserving high-priority forests would help protect clean water, providing a crucial ecosystem service given mounting concerns over water security in the western US (Law et al., 2021). Strong protections for mature and old-growth forests would increase water security for our nation.

Habitat

Large-diameter snags and large, downed logs provide critically important wildlife habitat (Rose et al., 2001; Lutz et al., 2021). There is currently a significant deficit of large snags (dead trees) in western US forests relative to the minimum habitat needs of many native cavity-nesting wildlife species (Bell et al., 2021). As mature forests age into older classes, snags are a natural outcome. However, logging often removes these snags for worker-safety concerns and because logging preferentially targets large-diameter trees that would otherwise become ecologically valuable snags and downed logs. Forests subjected to logging tend to stay impoverished of snags. Protecting mature and old forests would ensure future snags that support biodiversity and contribute to overall ecosystem health.

Example: Climate and biodiversity benefits of large tree protections

In the forests of eastern Oregon and southwest Washington, the Eastside Screens and 21-inch rule was implemented in the early 1990s as a habitat and species protection measure to recover large tree structure and to protect remaining late successional and old-growth forest and associated species (e.g. American Marten, Northern Goshawk) (Henjum et al., 1994; Bull and Hohmann, 1994; Bull et al., 2005), similar to the Northwest Forest Plan (NWFP) that was implemented to ensure persistence of old-growth forest species and their habitat in the western portion of the region (FEMAT, 1993). Carbon storage associated with the 21-inch rule on the six national forests is a significant co-benefit of this protective measure (Mildrexler et al., 2020). Large trees (DBH ≥ 21 in) constitute ~3% of the total stems in these forests, but store over 42% of total aboveground carbon in these forests. The 21-inch rule is an excellent example of a policy initiated for wildlife and habitat protection that has also provided significant climate mitigation values across extensive forests of the PNW Region (Pörtner et al., 2021; Mildrexler et al., 2023).

Mildrexler et al. (2023) described valuable synergies with protecting large and old trees for climate and biodiversity protection and restoration objectives in dry forests and concluded the following:

> Mature and old growth forests can make a significant contribution to climate mitigation goals by protecting and enhancing carbon stores in large trees that accumulate and store the most carbon and are much more resistant to fire and drought than small trees, even when the current status of ecosystems has changed from historical baselines. Climate science makes clear that we do not have time to wait for regrowth after logging to accomplish these important ecosystem services (IPCC, 2023).

7. Restoration Needs in Old-Growth Forests are Distinct and Limited.

In context of the broader forest landscape, old-growth forests are highly intact systems with limited restoration needs. These diverse and complex systems are also vulnerable to management interventions that degrade and destabilize the forest community. Climate change is compounding decades of degradation caused by ill-considered management of the Nation's forests. But research indicates that logging old-growth forests will only exacerbate the problems. At most, the literature points to a targeted role for intervention in frequent-fire old-growth forests with emphasis on restoring the process of periodic surface fire.

The DEIS relies on ill-suited research to develop the argument that it needs broad authority to engage in active management of old growth. The agency's analysis often points to studies focused on restoration in heavily logged areas and tree plantations (e.g. Case et al., 2023; Hood et al., 2016) (DEIS at 39, 41). But the ecological needs in forests subject to historical mismanagement such as clear-cutting and high-grade logging are significantly different from those in existing old-growth forests. Among other things, restoration approaches from these studies often involve commercial thinning which is directly tied to the previous management of these areas. Blurring management history of old growth with intensively managed sites risks conflating commercial approaches not appropriate in old-growth forests. Moreover, studies on promoting development of old growth characteristics have limited relevance in the context of developing policies for protecting existing old growth. Old-growth forests do not need treatments to promote old growth-like characteristics.

In addition, the DEIS ignores the scientific literature suggesting that restoration work in old-growth forests is, at best, appropriate in a highly limited set of circumstances and can often be accomplished with minimal intervention such as restoring fire. For instance, there's no support for logging old-growth trees (as noted above). Nor in forests with long fire-return intervals—such as Pacific Northwest forests old-growth (Franklin and Johnson, 2012; Schoennagel et al., 2004). Franklin and Johnson (2012) state:

> Management activities in these existing old-growth [moist forests], such as thinning, are not needed to sustain conditions in these forests and can actually cause old-growth MFs to diverge widely from natural forests in structure and function or become destabilized.

Targeted intervention can be efficacious in forests with short fire-return intervals, if carefully calibrated. Old-growth forests in the mixed-severity fire regimes will vary, but prescribed fire with a range of severities, alongside indigenous cultural burning priorities, will help reduce future wildfire threats and increase ecological benefits in many systems without mechanical intervention (Schoennagel et al. 2017; Long et al., 2021). Even in the low-severity fire regimes in low elevation ponderosa pine forests, old-growth forests have distinct restoration needs compared to heavily logged sites.

As an example, consider restoration of the dry ponderosa pine type, which is a major focus of the DEIS. At 41 the DEIS describes studies that took place in a second-growth forest that established after widespread harvesting in the late 1800s–early 1900s, and a second-growth stand of ponderosa pine and Douglas-fir that was selectively cut starting in 1907 and partially cut in 1955, 1967, and 1979–1980 (Hood et al., 2016; 2020). Restoration needs in these dry forests are driven by the intensive logging that removed the large-dominant trees decades ago followed by fire suppression. These studies are common in the literature due to the widespread logging of the ponderosa pine forest type which tends to occupy lower elevations in the western US.

Another study sought to specifically understand how historical logging impacted stand structure and thus restoration needs between paired logged and unlogged fire-excluded sites in ponderosa pine forest of the northern Rockies (Naficy et al., 2010). The abstract of this study reveals that restoration needs in old-growth ponderosa pine forests are distinct from their historically logged counterparts, and at risk of degradation from management approaches derived from previously logged forests (Naficy et al., 2010).

> Increased forest density resulting from decades of fire exclusion is often perceived as the leading cause of historically aberrant, severe, contemporary wildfires and insect outbreaks documented in some fire-prone forests of the western United States. Based on this notion, current U.S. forest policy directs managers to reduce stand density and restore historical conditions in fire-excluded forests to help minimize high-severity disturbances. Historical logging, however, has also caused widespread change in forest vegetation conditions, but its long-term effects on vegetation structure and composition have never been adequately quantified. We document that fire-excluded ponderosa pine forests of the northern Rocky Mountains logged prior to 1960 have much higher average stand density, greater homogeneity of stand structure, more standing dead trees and increased abundance of fire-intolerant trees than paired fire-excluded, unlogged counterparts. Notably, the magnitude of the interactive effect of fire exclusion and historical logging substantially exceeds the effects of fire exclusion alone. These differences suggest that historically logged sites are more prone to severe wildfires and insect outbreaks than unlogged, fire-excluded forests and should be considered a high priority for fuels reduction treatments. Furthermore, we propose that ponderosa pine forests with these distinct management histories likely require distinct restoration approaches. We also highlight potential long-term risks of mechanical stand manipulation in unlogged forests and emphasize the need for a long-term view of fuels management.

Naficy et al (2010) states:

> The current forest structure and composition that we have documented in logged forests suggests that, where fuel reduction goals are primary, these forests should constitute a clear priority.….**This is consistent with growing evidence that labor intensive and costly mechanical treatments in many unlogged, fire-excluded forests may not be necessary to restore wildfire despite structural departures from historical conditions.** [emphasis added]

It bears reiterating, in reviewing the literature cited in the DEIS and beyond, there is no support for logging large or old-growth trees for old-growth restoration. Prescribed fire, cultural burning, and removal of small trees where needed to safely reintroduce fire can support resilience in forests with frequent-fire regimes and minimize carbon losses from these systems. Research into ecological restoration in frequent-fire forests recommends retaining large and old trees, while carefully reducing surface and ladder fuels, and reintroduction of low-intensity fire at appropriate intervals (Allen et al., 2002; Brown et al., 2004; Agee and Skinner, 2005; Noss et al., 2006).

Reinforcing this point, many of the studies cited in the DEIS describe the synergies of removing small trees, reintroducing fire, and protecting large trees. Studies that consider carbon stocks and climate change argue the need to limit removals to small trees, because even thinning smaller trees involves substantial carbon tradeoffs in the short term, a 30-40% reduction in live tree carbon stores in some forests (James, et al. 2018; Krofcheck et al., 2017; North et al., 2009). For example, thinning in a young ponderosa pine plantation showed that removal of 40% of the tree biomass would release about 60% of the carbon over the next 30 years (Stenzel et al., 2021).

One of the studies cited in the DEIS was an opinion paper with a section stating, "Small Trees, Big Problem" (Hurteau et al., 2019).

> Compared with large overstory trees, small trees accumulate carbon at a much slower rate and have higher rates of mortality, yet they compete for resources with large trees. In seasonally dry forests, fire reduces small tree density, spurring growth in large, long-lived trees that store more carbon.
>
> - Hurteau et al., 2019

Here are excerpts from studies, several of which are cited in the DEIS.

Management to reduce stand-replacing fire risk typically involves thinning small trees and prescribed burning, both of which reduce the amount of carbon stored in the forest.

- Krofcheck et al. 2019

Previous studies have demonstrated that restoration treatments that focus on removing smaller trees and restoring surface fire can substantially increase canopy base height while at the same time minimizing reductions in live tree C and increasing C stability.

- Liang et al. 2018

Currently, a large body of work supports tactics to resist conversion, although these pertain primarily to frequent-fire forest types. Well-established fuel reduction techniques emphasize the retention of larger-diameter trees with thick bark and other adaptations to fire, the removal of understory and ladder fuels that promote the transition from surface to crown fire, and maintenance burning.

- Coop et al. 2020

The goals of restoring ecosystem processes and/or reducing risk in fire-prone regions can be met by removing small trees and underburning to reduce surface fuels, not by removal of larger trees, which is sometimes done to offset the cost of the thinning. With continued warming and the need to adapt to wildfire, thinning may restore more frequent low-severity fire in some dry forests, but could jeopardize regeneration and trigger a regime change to non-forest ecosystems.

- Law et al. 2022

In dry forests historically maintained by a frequent, low-severity fire regime, the priority ought to be restoring the process of periodic surface fire. Prescribed fires create landscape heterogeneity, reduce surface and ladder fuels, lower stand density, and confer drought resistance to surviving trees.

- Mildrexler et al. 2023

8. Protecting Old Growth is Powerful Near-Term Integrated Climate Action

The climate crisis will continue to accelerate in the coming decades. We are already witnessing an alarming and unprecedented succession of climate extremes and widespread impacts to humanity and all life on Earth (Ripple et al., 2023). The actions we take now will have long-term impacts on future generations. A reduction in fossil fuel emissions is the single most important measure for mitigating climate change; however, logging is the second largest emitter of greenhouse gases to the atmosphere globally (IPCC, 2018).

Protecting old-growth forests is one of the most effective and strategic options we can take for managing atmospheric carbon dioxide and meeting urgent climate goals. But to be effective, protections must safeguard old-growth forests from degradation, chiefly by protecting large-diameter and old-growth trees and infrequent-fire old-growth forests from logging. And such protections must recognize the targeted nature of restoration needs in frequent-fire old-growth forests. The sooner these forests are protected, the more climate protection they can provide.

The United States contains the fourth largest forest estate in the world, and the US Forest Service manages about 20% of it. The Forest Service could become a global leader in safeguarding Earth's climate and biodiversity by protecting our old-growth forests.

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Appendix B

ILLUSTRATION OF PART II CORE RECOMMENDATIONS AND ADDITIONAL SUGGESTIONS

NOTE: The core recommendations discussed in Part II are highlighted. Plain or *italic* text is original from the Draft Environmental Impact Statement. ~~Strikethrough~~ represents language that is recommended for deletion, while bold represents language that should be added.

STATEMENT OF DISTINCTIVE ROLES AND CONTRIBUTIONS (NOGA-FW-DRC)

The National Forest System plays a distinctive and key role in providing the nation with benefits related to national forests and grasslands within the broader landscape, including old-growth forests. Old-growth forests are dynamic systems distinguished by old trees and related structural attributes. Old-growth forest typically differs from other stages of stand development in a variety of characteristics, including the presence of old trees, variability in canopy structure, patchiness, and development pathways depending on disturbance regimes and resulting patterns. The structure, composition, and characteristics of old-growth forests is highly ecosystem and place-based. What constitutes old-growth forest is informed by best available science, which includes Indigenous Knowledge.

Old-growth forests support ecological integrity and contribute to distinctive ecosystem services—such as long-term storage of carbon, increased biodiversity, improved watershed health, and social, cultural, and economic values. Old-growth forests have place-based meanings tied to cultural identity and heritage; local economies and ways of life; traditional and subsistence uses; aesthetic, spiritual, and recreational experiences; and Tribal and Indigenous histories, cultures, and practices. Tribal and Indigenous practices have maintained resilient forest structure and composition of forests that harbor high structural and compositional diversity, with particular emphasis on understory plants and fire-dependent wildlife habitat.

GOAL 1 (NOGA-FW-GOAL-01)

Interpretation and implementation of the old-growth amendment is grounded in recognition and respect for tribal sovereignty, treaties, Indigenous Knowledge and the ethic of reciprocity and responsibility to future generations. Implementation of the old-growth amendment enables co-stewardship, including for cultural burning, prescribed fire, and other activities, and occurs in consultation with Tribes and Alaska Native Corporations to fulfill treaty obligations and general trust responsibilities.

MANAGEMENT APPROACH 1.A (NOGA-FW-MA-01A) *Adaptive Strategy for Old-Growth Forest Conservation*

Develop and adhere to an *Adaptive Strategy for Old-Growth Forest Conservation* to accomplish the following:

i. Effectively incorporate place-based Indigenous Knowledge and other forms of Best Available Scientific Information as equals to inform and prioritize planning and decision-making for the conservation and recruitment of old-growth forests through **passive stewardship or** proactive stewardship.

ii. Ground-truth the accuracy of applied old-growth forest definitions.

iii. Provide geographically relevant information about threats, stressors, and management opportunities relevant to ~~the ecosystem~~ **forest types in** ~~of~~ the plan area to facilitate effective implementation.

iv. Identify tribal priorities and opportunities to support cultural, medicinal, food, and ceremonial values, practices and uses.

v. Identify and prioritize areas for the recruitment, retention and promotion of old-growth forests, based on: ecological integrity, inherent capability, threats, stressors, and opportunities relevant to the plan area in order to provide for the long-term resilience of old-growth forests conditions within the plan area.

vi. Engage in climate adaptation using explicit resistance, resilience, or transition approaches to address climate risks and achieve desired conditions, or otherwise intentionally accept alternative climate-driven outcomes.

vii. Engage in climate mitigation using approaches that increase carbon stored in forest ecosystems, both above and below ground.

~~vii.~~ **viii.** Identify a program of work and partnerships that can support effective delivery of the plan monitoring requirements to inform adaptive management.

~~viii.~~ **ix.** Recognize the role of other successional stages that are important for ecological integrity**, including, but not limited to, complex early seral forest (aka preforest)**.

MANAGEMENT APPROACH 1.B (NOGA-FW-MA-01B) *Adaptive Strategy for Old-Growth Forest Conservation*

Identify areas that have the inherent capability to sustain future old-growth forest (i.e. areas of likely climate or fire refugia) over time and prioritize them for **passive stewardship or** proactive stewardship for one or more of the following purposes:

i. To provide for long-term resilience;

ii. To reduce **unnatural** fire hazard, spread or severity, or the spread of **unnatural** ~~potential~~ insect or disease outbreaks**, and allow for the return of natural disturbance regime**s;

iii. To provide landscape-level redundancy and representation of old-growth forests;

iv. To enhance landscape and patch connectivity where old-growth patches are isolated;

v. To recruit and promote the development of future old-growth forests where current conditions in mature forest are likely to achieve the old-growth forest definitions and associated criteria in the shortest timeframe possible;

vi. To retain and promote the development of old-growth forests in watersheds, firesheds, or other relevant landscape units where amounts and distributions of existing old-growth forests lack resilience and adaptability to stressors and likely future environments; **or**

vii. To restore or enhance attributes identified as culturally significant**.**~~; or~~

~~viii. To promote climate adapted species assemblages in areas where changing climatic conditions are likely to alter current conditions and change species assemblages over time.~~

MANAGEMENT APPROACH 1.C (NOGA-FW-MA-01C) *Adaptive Strategy for Old-Growth Forest Conservation*

One or more Forest Service units may create a joint *Adaptive Strategy for Old-Growth Forest Conservation.* An already existing strategy or other document may also be used if it meets this intent and contains, or is amended to contain, all substantive elements described for Management Approach 1(a) and 1(b).

MANAGEMENT APPROACH 1.D (NOGA-FW-MA-01D) *Adaptive Strategy for Old-Growth Forest Conservation*

Include the *Adaptive Strategy for Old-Growth Forest Conservation* as an appendix to either the broader scale monitoring strategy or the biennial monitoring report, see 36 CFR 219.12. Units should use this strategy to inform priorities. The strategy may be periodically updated (36 CFR 219.13(c)) to reflect new information and monitoring results.

DESIRED CONDITION 1 (NOGA-FW-DC-01)

Old-growth forests occur in amounts and levels of representativeness, redundancy, and connectivity such that conditions are resilient and adaptable to stressors and likely future environments **and grounded in the highest level of natural range of variation (FSH 1902.12) appropriate to the forest type in the plan area**.

DESIRED CONDITION 2 (NOGA-FW-DC-02)

Old-growth forests persist **locally** in areas that have the inherent capability to sustain old-growth forests over time **and at the landscape scale in areas where stand-replacing disturbance is expected**.

DESIRED CONDITION 3 (NOGA-FW-DC-03)

The long-term abundance, distribution, and resilience of old-growth forests within the plan area contribute to ecosystem services across the National Forest System, including but not limited to long-term **increased** stability of forest carbon, clean water and soil stabilization, plant and animal habitat, spiritual and cultural heritage values and education, and recreational and tourism experiences.

DESIRED CONDITION 4 (NOGA-FW-DC-04)

Old-growth forests contribute to the ecological integrity of terrestrial and aquatic ecosystems within the plan area, in concert with other successional stages that are also necessary for ecological integrity.

OBJECTIVE 1 (NOGA-FW-OBJ-01)

Within 2 years of the old-growth amendment record of decision, in consultation with Tribes and Alaska Native Corporations and in collaboration with interested States, local governments, industry and non-governmental partners, and public stakeholders, create or adopt an *Adaptive Strategy for Old-Growth Forest Conservation* based on geographically relevant data and information for the purpose of furthering old-growth forest desired conditions.

OBJECTIVE 2 (NOGA-FW-OBJ-02)

Within one year of completing the *Adaptive Strategy for Old-Growth Forest Conservation Strategy*, integrate priorities identified in the *Strategy* into the unit's outyear program of work and initiate at least three ~~proactive~~ stewardship projects/activities in the planning area to contribute to the achievement of old-growth forest desired conditions, **at least one of which shall be passive stewardship.**

OBJECTIVE 3 (NOGA-FW-OBJ-03)

Within two years of completing the *Adaptive Strategy for Old-Growth Forest Conservation Strategy,* initiate at least one co-stewardship project with interested Tribes for the purpose of **passive stewardship or** proactive stewardship.

OBJECTIVE 4 (NOGA-FW-OBJ-04)

Within ten years of the *Adaptive Strategy for Old-Growth Forest Conservation* being completed, forest ecosystems within the plan area will exhibit a measurable, increasing trend towards appropriate amounts, representativeness, redundancy, and connectivity of old-growth forest that are resilient and adaptable to stressors and likely future environments.

STANDARD 1 (NOGA-FW-STD-01)

Vegetation management activities must not degrade or impair the composition, structure, or ecological processes in a manner that prevents the short- or long-term persistence of old-growth forest conditions at the site-specific area. The definitions and associated criteria used to identify old growth are not guidelines for management. Once an area has been identified as an old-growth forest, it will continue to be administered as such, including during periods when it is exhibiting other seral stages.

STANDARD ~~1~~ **2** (NOGA-FW-STD-0~~1~~**2**)

Old-growth forests will be ~~determined~~ **identified** using definitions and associated criteria established in the land management plan. Where these definitions and associated criteria are found to be incomplete (i.e. only address some but not all ecosystems found in the planning area for which old-growth forest does or may exist) or are non-existent in the plan, the planning unit's corresponding regional old-growth forest definitions and associated criteria, or successor regional definitions and criteria, will be applied in part when these are incomplete or in full when non-existent. **Do not use minimum definitions for old-growth forests as a target for management outcomes.**

STANDARD ~~2~~**3**.A (NOGA-FW-STD-0~~2~~**3**A)

Where conditions meet the definitions and associated criteria of old-growth forest, vegetation management may only be for the purpose of **passive stewardship or** proactive stewardship. For the purposes of this standard, the term "vegetation management" includes – but is not limited to – prescribed fire, timber harvest, and other mechanical/non-mechanical treatments used to achieve specific silviculture or other management objectives (e.g. hazardous fuel reduction, wildlife habitat improvement).

For the purpose of these standards, the term "passive stewardship" refers to management that encourages and allows natural ecosystem process and function, including, but not limited to, natural succession.

For the purposes of ~~this~~ **these** standard**s**, the term "proactive stewardship" refers to vegetation management that promotes the quality, composition, structure, pattern, or ecological processes necessary for old-growth forests to be resilient and adaptable to stressors and likely future environments. Proactive stewardship in old-growth forests shall promote one or more of the following:

i. reduction of hazardous fuels to reduce the risk of loss of old-growth forests to ~~uncharacteristic~~ **unnatural** wildfire, and to facilitate the return of appropriate fire disturbance regimes and conditions;

ii. resilience to **unnatural** insect and disease outbreaks that would result in the loss of old-growth conditions;

iii. ecological conditions for at-risk species associated with old-growth forest, including conditions needed for the recovery of threatened and endangered species;

iv. amount, density, distribution and species composition of old trees, downed logs, and standing snags appropriate for the forest ecosystem type;

v. vertical and horizontal distribution of old-growth structures, including canopy structure and composition;

vi. patch size characteristics, percentage or proportion of forest interior, and connectivity;

vii. types, frequencies, severities, patch sizes, extent, and spatial patterns of disturbances **needed to retain or develop old-growth characteristics in the future**;

viii. successional pathways and stand development **needed to retain or develop old-growth characteristics in the future**;

ix. connectivity and the ability of old-growth obligate species to move through the area and cross into adjacent areas;

x. culturally significant species or values, to include key understory species;

xi. species diversity, and presence and abundance of rare or unique habitat features associated with old-growth forests; or

xii. other key characteristics of ecological integrity associated with old-growth forests.

STANDARD ~~2~~**3**.B (NOGA-FW-STD-0~~2~~**3**B)

The cutting or removal of trees in old-growth forest for purposes other than proactive stewardship is permitted when (1) incidental to the implementation of a management activity not otherwise prohibited by the plan, and (2) the area – as defined at an ecologically appropriate scale – continues to meet the definition and associated criteria for old-growth forest after the incidental tree cutting or removal. **Such cutting or removal shall not result in commercial timber harvest. Such cutting or removal may be permitted under this exception only when it has been demonstrated in the project's environmental review that there is no other reasonable way to design or conduct the otherwise authorized activities in a manner that would avoid cutting or removing old growth.**

STANDARD ~~2~~**3**.C (NOGA-FW-STD-0~~2~~**3**C)

Deviation from Standard 2.a and 2.b may only be allowed if the responsible official determines that vegetation management actions or incidental tree-cutting or removal are **the minimum** necessary for the following reasons and includes the rationale in a decision document or supporting documentation:

i. In cases where this standard would preclude achievement of wildfire risk management objectives within municipal watersheds or the wildland-urban interface (WUI) as defined in Section 101 of the Healthy Forest Restoration Act of 2003 (16 USC 6511) and its application by the local planning unit **and also within 100 feet of a structure**, or would prevent protection of critical infrastructure from wildfire;

ii. to protect public health and safety **that cannot be achieved in other ways**;

iii. to comply with other statutes or regulations, valid existing rights for mineral and energy resources, or authorizations of occupancy and use **in the form of permits or contracts** made prior to the old-growth amendment decision;

iv. for culturally significant uses as informed by tribes ~~or for de minimis use for local community purposes~~; **or**

v. in areas designated ~~for research purposes, such~~ as experimental forests**.** ~~or research natural areas; or~~

~~vi. in cases where it is determined – based on best available science, which includes Indigenous Knowledge – that the direction in this standard is not relevant or beneficial to a particular species or forest ecosystem type.~~

STANDARD ~~3~~**4** (NOGA-FW-STD-0**4**)

~~Proactive stewardship in old-growth forests shall not be for the purpose of timber production as defined in 36 CFR 219.19.~~

Vegetation management shall not result in:

1. **Cutting of old-growth trees in any forest type or cutting of any trees in infrequent-fire old-growth forests, except (a) to abate a demonstrated, imminent risk to public safety, (b) via tree selection for Native American or Alaska Native traditional and customary uses, or (c) as required to effectuate a statute or treaty; or**
2. **Commercial timber harvest of old-growth trees in any forest type or any trees in infrequent-fire old-growth forests.**

GUIDELINE 1 (NOGA-FW-GDL-01)

In areas that have been identified in the *Adaptive Strategy for Old-Growth Forest Conservation* as compatible with and prioritized for the development of future old-growth forest, vegetation management projects should be for the purpose of developing those conditions.

GUIDELINE 2 (NOGA-FW-GDL-02)

Where there are additional land management plan components for old-growth that existed prior to the old-growth amendment and these provide more restrictive direction for old-growth forests, the more restrictive direction should be adhered to.

GUIDELINE 3 (NOGA-FW-GDL-03)

To preserve the **ecological,** cultural and historical value of old trees occurring outside of old-growth forests, vegetation management projects should retain and promote the conservation and survivability of old trees ~~that are rare when compared to~~ **for which** nearby forested conditions ~~that~~ are of a noticeable younger age class or **that are** unique in their ability to persist in the current or future environment~~, and are not detracting from desired species composition or ecological processes~~. **Management should also provide for the replacement and increase of old trees over time.**

PLAN MONITORING 1 (NOGA-FW-PM-01)

Within two years, include the areas identified and prioritized for the retention and promotion of old-growth forests in the *Adaptive Strategy for Old-Growth Forest Conservation* in the biennial monitoring report or the broader scale monitoring strategy to be updated as conditions change.

PLAN MONITORING 2 (NOGA-FW-PM-02)

Within the biennial monitoring evaluation report, provide monitoring questions and associated indicators to assess the resilience of old-growth forests and inform adaptive management; include regular updates on actions taken pursuant to this amendment; identify unintended consequences to other social, economic, or ecologic plan objectives; and provide updates on measurable changes in unit-level old-growth forest when new national inventory information is available.

Appendix C

I. Logging to address mesophication in old-growth forests is generally unnecessary and harmful.

Part III.A.ii.5 of these comments explains why protecting old-growth trees and infrequent-fire old-growth forests—two of our core proposals for improving the NOGA—would not conflict with management actions that the Forest Service seems to believe are appropriate to address mesophication. Separate from our recommendations for the NOGA, however, we are concerned that the agency is resorting to logging to address mesophication when such treatment is not necessary, beneficial, or scientifically justified.

The Eastern portion of the United States is home to numerous forest types and a diversity of fire regimes. Post-colonial land clearing and agriculture, followed by decades of intensive logging and fire suppression, have diminished the presence and abundance of old growth throughout the Eastern US. Indeed, many of the drivers/stressors identified in the Regional Old-Growth Summary and mesophication itself are direct outcomes of this history of management.

Nevertheless, old-growth forests in R8 and R9 are poised to resist the worst impacts of climate change, even or especially where mesophication is occurring. In R8 and R9, precipitation is increasing in intensity and in volume, which can lead to mesophication.[268] Furthermore, mesophytic forests are well suited to projected future conditions across R8 and R9 and support climate mitigation, biodiversity, flood resilience, and myriad other benefits.

The Forest Service writes: "Old-growth forests in the eastern United States are threatened by mesophication, a process characterized by the transition of oak, hickory, and other frequent-fire deciduous forests to shade-tolerant, late successional species-dominated forests. This phenomenon has been exacerbated by elimination of cultural burning and the suppression of fires, leading to a shift in plant communities towards more mesic species (Abrams and Nowacki (2020), Abrams et al. 2022, Hutchinson, 2024). The ongoing mesophication in forests is expected to persist, creating a climate disequilibrium in these ecosystems (Nowacki and Abrams, 2014)."[269]

There is significant evidence that, in addressing mesophication, the Forest Service is trying to prevent a return to precolonial forest types for which a given site remains well suited. The Buffalo Springs Restoration Project in Hoosier National Forest provides a good example. As detailed in a recent letter from Indiana Forest Alliance to the Deputy Chief,[270] the agency has proposed logging to improve the sustainability of oak-hickory ecosystems on the incorrect premise that such forest types were historically dominant within the project area. But data compiled by Indiana University's Historical Landscapes Laboratories from surveys conducted between 1804 and 1807 reveal that oaks and hickories comprised 21% and 6%, respectively, of the trees surveyed. Beech and maples comprised 43% and 12%.[271] Mesophication would return the forest to more closely resemble its precolonial composition, whereas the current oak-hickory dominance resulted from—and perpetually depends on—substantial human interference.

We do not dispute that mesophication is occurring; rather, we dispute the Forest Service's sweeping and unsupported conclusions that 1) mesophication is a universal threat to old-growth; 2) mesophytic forests are

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[268] Nix, S. et al. "Cheat Water Resources: Assessing Climatology and Land Cover
Trends and Evaluating Flood Risk of the Cheat River." NASA DEVELOP National Program Technical Report, Alabama – Marshall (2021).
https://ntrs.nasa.gov/api/citations/20210014209/downloads/2021Spring_MSFC_CheatWater_TechPaper_FD_Final.docx.pdf; Jong, B. et al. "Increases in extreme precipitation over the Northeast United
States using high-resolution climate model simulations." *Climate and Atmospheric Science* (2023) 6(18).
https://doi.org/10.1038/s41612-023-00347-w.

[269] DEAIR at 24.

[270] *See* Letter from Jeffrey Stant and Steven Stewart, Indiana Forest Alliance, to Christopher B. French, USDA Forest Service (Sept.5, 2024).

[271] *See id.* at 16.

uniformly less resilient to the effects of climate change; and 3) active interventions are necessary, practical, or beneficial, especially in the context of old-growth forests.

A. FORESTS UNDERGOING MESOPHICATION ARE POTENTIALLY WELL-SUITED TO FUTURE CLIMATE CONDITIONS.

The agency does little to support the assertion that forests undergoing mesophication lack resilience "to the projected altered climatic patterns."[272] Other agency reports seem to point in the opposite direction. The 2020 Resources Planning Act Assessment, for instance notes that "[w]hile the specific local ecological effects of fire depend on many factors, an increase in fire mortality volume could be beneficial to oak/hickory forests in the East if it signals more fire overall in that forest type."[273] In other words, even if a fire-resistant mesic forest were impacted by fire, the consequences would likely create beneficial opportunities for the recruitment of oak-pine-hickory forest types.

More broadly, mesophication is resulting in wetter, structurally complex forests that are less prone to fire, despite changing climatic conditions.[274] These forests will likely repel fire more effectively than dry forests, reducing the acreage that is likely to burn. The Forest Service acknowledges the uniquely fire-resistant qualities of mesophytic forests in the Threat Assessment Glossary:

> "[S]hade-tolerant species deter fire through dense shading that promotes moist, cool microclimates and the production of fuels that are not conducive to burning (flaccid, moisture- holding leaf drop; moist, rapidly decaying woody debris). This phenomenon is reinforced and amplified by feedback loops, whereby conditions continually improve for shade-tolerant mesophytic species and further deteriorate for shade- intolerant, fire-adapted species."[275]

B. MESOPHICATION TREATMENTS, IF WARRANTED AT ALL, SHOULD NOT BE DIRECTED AT OLD-GROWTH STANDS.

Even in locations where the Forest Service has, hypothetically, reasonably justified active management to address mesophication, it has a range of options that would not undermine the NOGA's goal of protecting existing old growth. To restore or maintain old growth impacted by mesophication, the agency can focus on younger stands and expand the use of "let burn" policies.

Managing to control mesophication—as Nowacki and Abrams (2008) appear to favor—requires spending vast amounts of resources to achieve an unclear goal with limited chance of success. These concerns are amplified by Forest Service analysts in a recent peer-reviewed article, noting that conditions in highly-mesophytic forests "make restoration increasingly difficult without considerable investment of resources, including multiple treatments that may include combinations of harvesting, fire, and herbicide conducted across many years and/or decades."[276] Considering the fact that older stands exhibit the highest levels of mesophication, targeting existing old growth for mesophication treatments is a costly proposition with consequences including the loss of habitat for rare or endangered species, the introduction of invasive species,[277] reductions in water quality and stored carbon, and the loss of flood and drought mitigation

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[272] *See* DEAIR at 45.

[273] Costanza, J.K. et al. "Future of America's Forest and Rangelands: Forest Service 2020 Resources Planning Act Assessment." *USDA Forest Service* Gen. Tech. Rep. WO-102. Washington, DC: 5-1–5-55 (2023). Chapter 5 at 5-12. https://doi.org/10.2737/WO-GTR-102-Chap5.

[274] *See* Woodbridge, M. et al. "Stand and environmental conditions drive functional shifts associated with mesohpication in eastern US forests." *Frontiers in Forests and Global Change* (2022) 5: 991934. https://doi.org/10/3389/ffgc.2022.991934.

[275] TA at 71.

[276] *See* Woodbridge, M. et al. "Stand and environmental conditions drive functional shifts associated with mesohpication in eastern US forests." *Frontiers in Forests and Global Change* (2022) 5: 991934. https://doi.org/10/3389/ffgc.2022.991934.

[277] Willms, J. et al. "The effects of thinning and burning on understory vegetation in North America: A meta-analysis." *Forest Ecology and Management* (2017) 392: 184–194. https://doi.org/10/1016/j.foreco.2017.03.010 ("Management in fire-

benefits of the existing, intact old-growth stand. Such negative tradeoffs, when properly accounted for, make mesophication-related interventions in old-growth a risky endeavor at best.

To the degree that any treatments are warranted to combat mesophication—a conclusion as yet unsupported by agency analysis—treatments should be directed to younger stands where there is the greatest benefit/cost ratio. Younger stands are a) more prevalent across the landscape; b) typically lack the composition, function, and complexity of older stands; c) likely experienced intense disturbance, including timber harvest, in the relatively recent past, making additional interventions a lower-risk for introduction of invasive species or degrading other measures of ecological integrity that are typically higher in old-growth sites.

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prone ecosystems relies widely upon application of prescribed fire and/or fire-surrogate (e.g., forest thinning) treatments to maintain biodiversity and ecosystem function…The most consistent effect of the treatments was the increase in non-native species following mechanical thinning and reduction in shrub cover following a burn.").

Appendix D

I. Reforms to reporting of climate consequences of forest management

The Forest Service must work to change its deeply embedded preferences for logging over other active and passive management activities. Leaving in place a dominant focus on logging forests for timber and pulpwood alongside a new focus on protecting old growth pits staff priorities and incentives against expanding the abundance and distribution of old-growth forests, a key purpose of the NOGA. The DEIS lacks numerical targets related to mature and old growth conservation. The agency should develop these, including—among other things—a clear accounting on forest carbon stocks and goals, and on forests conserved. And it should work to incorporate that accounting into its environmental review process for projects and forest plans.

A. New ecological targets should be established.

The agency should establish targets for ecological forest uses, specifically for carbon storage in trees and soils, increased wildlife protection, and expansion of mature and old-growth forests. Currently, the Forest Service sets annual timber targets for regions and forests in terms of board-feet of harvested wood to be sent to mills for timber or pulpwood extraction. The Forest Service's institutional structure places a thumb on the scales of its decision-making process. And we are seeing how this preference plays out: Even as the Forest Service works on the old-growth amendment, it continues logging mature and old-growth trees and forests—including under stewardship rationales—across the country. And the agency is not pursuing a meaningful strategy to ensure the robust recruitment of old growth.

Timber targets inherently incentivize the largest trees to be cut and prioritize projects that result in timber production over other forest uses. The agency must change this flawed incentive structure. As a start, it should develop new targets focused on ecological goals. In particular, the agency should establish numeric goals and required reporting and transparency for expanding the abundance and distribution of mature and old-growth forests, increasing carbon stores. And it should clearly disclose any ongoing cutting of mature and old growth.

B. Environmental review of forest plans and projects must recognize and quantify climate benefits and losses.

The agency should disclose the impacts of active management on atmospheric carbon and carbon sequestration as part of the environmental review for projects and forest plans. Environmental review of projects should not be avoided by substituting larger-scale reviews of forest plans and assessments at the forest-level that obscure the impacts of specific actions at smaller scales. The agency should develop methods to accurately assess impacts of logging projects on forest carbon cycles and stores in ways that reflect the best available science.

In Forest Service Resource Bulletin WO-101, published April 2023, the Forest Service describes generally how logging disrupts forest carbon cycles and stores, increasing atmospheric carbon pollution[278]:

> Instead, following harvesting, a portion of the carbon stored in wood may be transferred to a "product pool." Once in a product pool, the carbon is emitted over time as carbon dioxide (CO2) from decomposition, and as CO2, methane (CH4), nitrous oxide (N2O), carbon monoxide (CO), and other nitrogen oxides (NOx) when the wood product combusts, or the carbon in the product may be transferred and stored in solid waste disposal sites (SWDS).

However, the Forest Carbon Assessments (FCA) recently placed into use in some National Forests fail to recognize or quantify these forest carbon losses caused by logging of mature and old-growth forests. While

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[278] "Greenhouse Gas Emissions and Removals From Forest Land, Woodlands, Urban Trees, and Harvested Wood Products in the United States, 1990–2021." USDA Forest Service U.S. Department of Agriculture Resource Bulletin WO-101, April 2023. https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/GHG-Emissions-Removals.pdf.

the FCA analysis recognizes the great value of American forests and peatlands as carbon sinks, it excludes consideration of carbon dioxide emissions and lost forest growth when trees are logged, addressing only vehicle emissions. Given this fundamental omission, the Forest Service environmental review devalues mature and old growth, and does not accept or implement the scientific rationale underlying the NOGA to conserve, sustain, and develop mature and old-growth forests to mitigate climate change. Forest Plan amendments must change environmental review practices for vegetation management to make better informed decisions. The FCA analysis is vague on the impacts of carbon dioxide emissions from forest harvest on the atmosphere's increasing heat-trapping capacity. Rather, it is focused mainly on impacts of climate change itself on the resilience of forests managed by the USFS. As such, the resulting environmental review fails to address the most pressing environmental challenge of our time, controlling greenhouse gas emissions that are leading to a rapidly heating planet that is jeopardizing and diminishing forested lands across the country (and many other ecosystems around the world).

In lieu of analysis, the FCA template language makes sweeping statements to the effect that trees will continue to grow and sequester carbon after proposed logging takes place. These statements typically extend beyond the project area in question to claim offsets from the entire forest and assume that the forest will regenerate over time. For example, a typical claim in environmental assessments is that "[t]he forest will maintain as a carbon sink as stated in the Forest Carbon Assessment. [279]" The **degree** to which forests capture and store carbon before and after the proposed logging, and the time that it takes to restore lost carbon stocks, is ignored. Moreover, the analysis is silent on the direct forest carbon effects from the project's logging, preferring instead to focus on vehicle and equipment exhaust. Using this logic, carbon pollution from any logging project will be found to be infinitesimal in comparison to the forest as a whole. But if the project reduces the capacity of the forest *in the project area* to capture and store carbon, then the adverse effects of the project upon the human environment are of great concern.

While the stock analysis does estimate carbon pollution from harvest operations (logging, hauling, road work, and burning), it provides no useful information on the stores of carbon released to the atmosphere or how much carbon sequestration capacity will be lost due to this logging, when the timber sale areas again become carbon sinks, and how long it will take to return to pre-harvest carbon stores.

The current forest carbon assessment methodology substitutes a single forest-level discussion and analysis for project-level analyses in environmental review. The result of applying one analysis at the forest, rather than project, scale is to obscure the actual impact of the project, itself, on emissions of stored carbon and on lost sequestration capacity—typically mature and old-growth forest services. Project-scale analysis would, also, guide treatment decisions and activity choices for different stands, to better identify and protect mature and old-growth trees to improve carbon stewardship.

The FCA methodology systematically undervalues climate benefits of mature and old-growth forests when it argues that any negative carbon impacts will not be significant so long as the rest of the forest will continue to be a carbon sink. It does not address the degree to which the project in question increases or reduces carbon sink effects, or when. It does not estimate the cumulative effects of these impacts across multiple projects and fails to provide the high quality and accurate scientific analysis required of environmental review.

These approaches do not show to what *degree* the forests will remain a net carbon sink and the NOGA does not provide a methodology for valuing mature and old growth conservation nor for individual foresters to track carbon stocks and sequestration in their National Forest System units. To ensure effective implementation, the agency must develop such a methodology to provide decisionmakers and the public with sufficient information to assess the carbon and climate impacts of logging mature and old-growth forests.

[279] USDA Forest Service, Decision Notice and Finding of No Significant Impact Kidrick Vegetation Project 6 (Aug. 2024).

C. Forest Service must quantify forest carbon impacts.

Before an environmental review of a plan or project can be considered complete, the impacts to lost carbon sequestration capacity should be quantified. This sort of analysis will require looking at multiple factors, including:

- **Quantity of mature and old-growth trees to be logged.** This should include documentation of the areas containing mature and old-growth forests in the project area that would be degraded or lost due to logging.
- **Annual carbon sequestration capacity lost.** Destroyed carbon sequestration capacity from logging will increase carbon pollution in the atmosphere. The extent of resulting carbon pollution should be quantified on an annual and cumulative basis to quantify project carbon pollution in total and over time.
- **Stores of carbon removed and emitted**. Most carbon removed from the forest will return to the atmosphere over time via burning, decomposition or other pathways. This also becomes a form of carbon pollution as a result of forest disturbance from logging activities. Likewise, it takes time for a logged area to regain net carbon sequestration, after accounting for these carbon releases. The analyses should quantify these carbon releases in total and over time.
- **Sequestration break-even.** This refers to the time until return to pre-harvest annual sequestration capacity and carbon stores. The environmental review should quantify how long it will take the affected forest to provide carbon sequestration services as existed prior to project initiation *in the project area*. Broader references to the greater forest are not relevant for NEPA environmental review.[280]

A systematized forest carbon methodology based on forest carbon science for all vegetation management projects will result in meaningful and useful NEPA environmental review to accurately portray and consider the consequences of vegetation management projects and for individual forest harvests and timber sales. A standardized analysis of projects and landscape-scale carbon cycle impacts would allow for scientifically valid assessments, monitoring of cumulative effects, and comparisons across time within individual national forests. Resulting products would allow for data aggregation and reporting within and across all USFS regions. The Forest Service should implement this approach to carbon impacts in its environmental review for all logging projects.

Effectively implementing the NOGA will require a forest carbon methodology that is well-grounded in science to more accurately assess the carbon values of mature and old-growth forests.

[280] Additional considerations and guidance on how to properly account for mature and old growth carbon can be found in Climate Forests Coalition. Comments re: "National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change" (Apr. 10, 2023).

Appendix E

List of Exhibits

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