Data Submitted (UTC 11): 9/20/2024 4:00:00 AM
First name: Zack
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Comments: Dear Ms. Walker,

Standing Trees submits the attached comments regarding the U.S. Forest Service's Draft Environmental Impact Statement for Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System (referred to as the NOGA DEIS throughout this document). These comments are submitted in support of and as a compliment to other comments that Standing Trees has signed onto during this comment period. Thank you in advance for your careful consideration.

Thanks,

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

Dear Ms. Walker,

Standing Trees submits the following comments regarding the U.S. Forest Service's Draft Environmental Impact Statement for Amendments to Land Management Plans to Address Old-Growth Forests Across the National Forest System (referred to as the NOGA DEIS throughout this document). These comments are submitted in support of and as a compliment to other comments that Standing Trees has signed onto during this comment period. Thank you in advance for your careful consideration.

Standing Trees is an incorporated nonprofit dedicated to advancing policy and legal solutions that protect and restore New England's native forests. Standing Trees seeks to hold state and federal agencies accountable for their actions that affect forests, and to ensure that land-managers and policymakers follow the latest climate and biodiversity science.

Introduction

As noted by Executive Order 14072, "only a small fraction of the world's mature and old-growth forests remains." To address this opportunity, EO 14072 directs the USDA and USDOI to "manage forests on Federal lands, which include many mature and old-growth forests, to promote their continued health and resilience; retain and enhance carbon storage; conserve biodiversity; mitigate the risk of wildfires; [and] enhance climate resilience," among other goals.

The Forest Service's own analyses indicate the rarity of old-growth and the need to restore such ecosystems. In the Green Mountain National Forest (GMNF) Telephone Gap Integrated Resource Project (TGIRP) Landscape Assessment, for example, the Forest Service writes that that "Old growth conditions are[hellip]rare on the [GMNF]... Timber

harvesting since land abandonment in the early 20th century has perpetuated more frequent and larger-sized disturbances than would be typical under natural disturbance regimes (i.e. from insects, disease, wind, ice, floods, or beaver activity). Stands that have generally remained unmanaged since land abandonment have the greatest potential to develop old growth conditions over the next 100 years."1

The 2023 USDA Forest Service Climate Adaptation Plan notes that mature and old- growth forests are "often viewed as ideal candidates for increased conservation efforts, and are frequently found within areas designated as wilderness or roadless or other management areas where timber harvest is precluded." The USDA Forest Service Climate Adaptation Plan is wise to highlight the inverse relationship between timber harvest levels and amounts of mature and old-growth forests. As implied by the USDA Forest Service Climate Adaptation Plan, there is no greater threat to the extent of mature and old-growth forests on federal public lands than logging.

New England's Mature and Old-growth Forests in Context

Due primarily to human-driven forest conversion (i.e. development, agriculture) and degradation (i.e. logging, fragmentation), mature and old-growth forests, once common in the forested regions of the US, are today underrepresented compared to historical levels. Prior to European settlement, old-growth forests were the dominant land cover of northern New England, including the areas now within the boundaries of the White and Green Mountain National Forests. Today, just 0.3% of New England forests are older than 150 years.2 With the loss of such forests, elk, caribou, wolverine, wolves, and cougars, once common in Vermont, have been entirely eliminated. Pine marten, a species threatened by logging in New England,3 is a State of Vermont endangered species and persists in only two isolated patches of remote, interior forest. Salmon have long since failed to naturally reproduce due to habitat destruction and fragmentation. Brook trout, which depend on older forests, are also imperiled. Interior and old forest birds like wood thrush and Bicknell's Thrush are in decline,4 and a primary driver is logging.5 Forest structural complexity remains well below pre-European settlement levels.6 By nearly any objective measure of health, New England's forests have deteriorated drastically due to the logging of old-growth and mature trees.

According to the definitive paper on disturbance frequency and intensity in New England, "the estimated proportion of the landscape in old-growth forest (>150 years old) [was] 70-89%" before European settlement in regions dominated by northern hardwoods, including much of what is now the White and Green Mountain National Forests. "The proportion of the presettlement landscape in seedling-sapling forest habitat (1-15 years old) ranged from 1 to 3% in northern hardwood forests (Fagus-Betula-Acer-Tsuga) of the interior uplands." "The current estimates of 9-25% [seedling-sapling habitat] for the northern New England states are probably several times higher than presettlement levels." Gap size in Hemlock-Northern Hardwood forests averaged less than .75 acres. Beech was the dominant species among Northern Hardwoods, comprising perhaps 30% of the forest.

Stand-replacing events occurred, on average, only every 1,000 to 7,500 years.7

Today, old-growth forests are functionally absent from northern New England.8 The Forest Service estimates that just [frac14] of one percent of the White Mountain National Forest, and [frac12] of one percent of the Green Mountain National Forest, are in an old-growth condition, according to Appendix 2 of the NOGA DEIS Draft Ecological Impacts Analysis.

Across Region 9, the Forest Service estimates that just 1/10 of one percent of the northern hardwood forest type is in an old-growth condition (DEIS at 64).

Large blocks of intact forest minimize harmful vectors for the spread of invasive species and allow natural disturbances to play out across a sufficiently large landscape to ensure that there is a mix of early and late successional habitats required by the full spectrum of New England's forest-dependent species. Recent studies show that unlogged forests in New England exhibit the greatest structural complexity and tree species diversity.9 Although passive management is most often all that's required to restore old forest conditions,10 it takes centuries to develop forest complexity, requiring permanent protection from timber harvest if restoration is to be successful.11,12,13,14,15

Threats to mature and old-growth forests

Logging is the single greatest influence on the amount and extent of mature and old- growth forests across the US, and is easily the most preventable threat to mature and old- growth forests. A 2013 study found that "Logging is a larger cause of adult tree mortality in northeastern U.S. forests than all other causes of mortality combined."16 This finding was reinforced in another study from 2018: "[Logging] comprises more than half of all mortality (on a volume basis), making logging the predominant disturbance[mdash]natural or anthropogenic[mdash] affecting forest ecosystems in the region."

This level of timber harvest has a significant impact on forest carbon - far greater than any other factor. Timber harvest drives 92% of annual forest carbon losses in the US South, 86% in the North, and 66% in the West. For comparison, the second greatest impacts on forest carbon in each region are as follows: West: fire (15%); North: insect damage (9%); South: wind damage (5%).17

Old-growth represents a tiny fraction in each region of the United States outside of Alaska, demonstrating the need for policies that put a greater percentage of forests on a path to recover late successional forests. In the Eastern US, old-growth comprises just 1.6% of South-Central US forests, 1.1% of the Upper Midwest forests, .5% of Southeast US forests, and .4% of forests in the Northeast.18

As evidenced above, the Northeast US has lost a greater percentage of its old-growth forests than perhaps any other region of the US. Private lands across New England are managed more intensively for timber harvest compared with federal public lands.19 This is especially pronounced in the northern New England states of Maine, New Hampshire and Vermont, where the vast majority of forests are privately owned. Recent modeling suggests that logging, not forest conversion, will continue to be the greatest factor in regional aboveground forest carbon over at least the next 50 years.20

Although there is a large amount of maturing forest across the landscape, future harvests will target these forests where they occur on private lands.21 Despite widespread forest maturation, rates of timber harvest in New England are such that trends in regional amounts of late successional forest structure are static, and the amount of large diameter standing snags is declining.22 "Even though forests of the Northeast are aging, changes in silviculture and forest policy are necessary to accelerate restoration of old-growth structure."23 As we have argued in previous comments, protecting stands and trees on federal forests over the age of 80 is exactly the sort of policy that will allow mature and old- growth forests to return to New England's landscape at a meaningful scale.

The exceptional values of mature and old-growth forests

1. Forest Carbon

There is a common misconception that young forests are better than old when it comes to removing carbon in the atmosphere. First of all, old forests store much more carbon than young forests, and they continue to accumulate carbon over time.24,25,26 What's more, the rate of carbon sequestration also increases as trees age.27 It can take up to 30 years after a regeneration cut for a young forest to become a carbon sink instead of a carbon source.28

Today, despite tree cover across the vast majority of the northern New-England landscape, the region's forests do not produce high levels of ecosystem services due to current management practices, including harvest frequency and intensity, and are still recovering from extensive clearing in the eighteenth and nineteenth centuries. A 2019 paper by Harvard Forest researchers found that:

"Among land uses, timber harvesting [has] a larger effect on [aboveground carbon] storage and changes in tree composition than did forest conversion to non-forest uses[hellip] Our results demonstrate a large difference between the landscape's potential to store carbon and the landscape's current trajectory."29

Northeast secondary forests have the potential to increase biological carbon sequestration 2.3-4.2-fold.30 A 2011 paper by UVM Professor Bill Keeton found that:

"[hellip]There is a significant potential to increase total carbon storage in the Northeast's northern hardwood-conifer forests. Young to mature secondary forests in the northeastern United States today have aboveground biomass (live and dead) levels of 107 Mg/ha on average (Turner et al. 1995, Birdsey and Lewis 2003). Thus, assuming a maximum potential aboveground biomass range for old-growth of approximately 250-450 Mg/ha, a range consistent with upper thresholds in our data set and the lower threshold observed at Hubbard Brook, our results suggest a potential to increase in situ forest carbon storage by a factor of 2.3-4.2, depending on site-specific variability. This would sequester an additional 72-172 Mg/ha of carbon."31

Forests in temperate zones such as in the Eastern U.S. have a particularly high untapped capacity for carbon storage and sequestration because of high growth and low decay rates, along with exceptionally long periods between stand replacing disturbance events, similar to the moist coastal forests of the Pacific Northwest. Further, because of recent recovery from an extensive history of timber harvesting and land conversion for agriculture in the 18th, 19th, and early 20th centuries, median forest age is about 75 years,32 which is only about 25-35% of the lifespan of many of the common tree species in these forests.33 Because of our remarkable forest ecosystems here in Northeastern North America, several global studies have highlighted the unique potential of our temperate deciduous forests to contribute on the global stage to climate stabilization and resilience.34,35

A 2013 study provides proof that protecting forests from logging is as close to a guarantee as there is for securing long-term carbon sequestration and storage. Strict protected areas prohibiting logging (i.e. GAP 1, IUCN Category 1, or equivalent classification) cover just 5% of the total land area of the mid-Atlantic and Northeast US (VA, PA, DE, NJ, NY, CT, RI, MA, VT, NH, ME). However, these protected areas account for "30% of the carbon stored in all forests in the region."36

1. Climate Resilience and Water Quality

Old forests are also the most resilient to changes in the climate, producing the highest outputs of ecosystem services like clean water, and reducing the impacts of droughts and floods. These ecosystem services protect downstream communities from flooding, purify drinking water at low cost, and maintain base flows and low temperatures in rivers during hot summers for the benefit of fish and wildlife.

In New England, frequent flooding and nutrient-driven water quality degradation are two of our most costly environmental crises, and both are compounded by climate change. Mature and old forests naturally mitigate against flooding and drought by slowing, sinking, and storing water that would otherwise rapidly flow into our streams, rivers, and lakes.37 Scientists have also shown that old forests are exceptional at removing nutrients that drive harmful algae blooms, like phosphorus.38

After Tropical Storm Irene ravaged New England in 2011, Vermont's Department of Forests, Parks, and Recreation commissioned a report entitled "Enhancing Flood Resiliency of Vermont State Lands." According to the report:

"There may be a tendency to assume that lands in forest cover are resilient to the effects of flooding simply by virtue of their forested status. However, forest cover does not necessarily equate to forest health and forest flood resilience. Headwater forests of Vermont include a legacy of human modifications that have left certain land areas with a heightened propensity to generate runoff, accelerate soil erosion, and sediment streams. These legacy impacts affect forest lands across the state... The quality of [today's] forests is not the same as the pre-Settlement old growth forests. The legacy of early landscape development and a history of channel and floodplain modifications continue to impact water and sediment routing from the land."39

A 2019 study led by the University of Vermont looked into the climate resilience of older compared to younger forests. The research found that:

"[Older forests] simultaneously support high levels of carbon storage, timber growth, and species richness. Older forests also exhibit low climate sensitivity[hellip]compared to younger forests[hellip] Strategies aimed at enhancing the representation of older forest conditions at landscape scales will help sustain [ecosystem services and biodiversity] in a changing world[hellip] Although our analysis suggests that old forests exhibit the highest combined [ecosystem services and biodiversity (ESB)] performance, less than 0.2% of the investigated sites are currently occupied by forests older than 200 years. This suggests a large potential to improve joint ESB outcomes in temperate and boreal forests of eastern North America by enhancing the representation of late-successional and older forest stand structures[hellip]" 40

Because of the overwhelming science in support of recovering America's old-growth forests, a recent peer-reviewed paper calls for the establishment of Strategic Carbon Reserves, with an emphasis on roadless, maturing forests. The paper finds that:

* "Many of the current and proposed forest management actions in the United States are not consistent with climate goals... [P]reserving 30 to 50% of lands for their carbon, biodiversity and water is feasible, effective, and necessary for achieving them."
* "Instead of regularly harvesting on all of the 70% of US forest land designated as 'timberlands' by the US Forest Service, setting aside sufficient areas as Strategic Reserves would significantly increase the amount of carbon accumulated between now, 2050 and 2100, and reestablish greater ecosystem integrity, helping to slow climate change and restore biodiversity."
* "Preserving and protecting mature and old forests would not only increase carbon stocks and growing carbon accumulation, they would slow and potentially reverse accelerating species loss and ecosystem deterioration, and provide greater resilience to increasingly severe weather events such as intense precipitation and flooding."41

1. Biodiversity

Many of New England's native fish and wildlife species, including those that are often most imperiled, such as the Northern Long-eared Bat, pine marten, brook trout, Blackburnian and Cerulean Warblers, Scarlet Tanagers, and Wood Thrush, depend on large, unfragmented landscapes and structurally-complex old forests for suitable habitat.42,43 Mature, unfragmented, interior forests are rare in New England overall, making the Green and White Mountain National Forests important concentrations of such habitat within New England. When this habitat is fragmented or degraded, such as through road construction and logging projects, these species experience increased threats from interactions with humans, predation, changes in microclimates, the spread of invasive species, and other fragmentation and edge effects.

Pine marten are on the State of Vermont Endangered Species List, and one of only two viable populations in the state is located within the Green Mountain National Forest. 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[.]"44 The same study found that "Marten[hellip]showed lower initial occupancy probability in areas of increasingly disturbed forest and had both higher extinction rates and lower colonization rates in these areas."45

Northern long-eared bats were recently added to the federal endangered species list. The Northern long-eared bat depends on mature and old forests for roosting and foraging.46 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.47

The NOGA DEIS Purpose and Need are Unmet by All Alternatives

A clear intent of the NOGA is to improve the ecological integrity of old-growth and to expand its distribution and abundance. Following are three statements of purpose and need, or intent, excerpted from the DEIS:

1. The purpose of the NOGA includes: "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" [emphasis added].48
2. The need includes: "Create a consistent framework to manage for the long-term persistence, distribution, and recruitment of old-growth forests across the National Forest System (NFS) in light of the interacting biophysical and social factors that threaten the persistence of older forests on NFS lands across the Nation" [emphasis added].49
3. The DEIS adds: "This proposed amendment is intended to create a consistent framework for managing old-growth forests with sufficient distribution, abundance, and ecological integrity (composition, structure, function, connectivity) to be persistent over the long term, in the context of climate amplified stressors" [emphasis added].50

None of the DEIS Alternatives will meet the statements of purpose and need listed above. Not one standard or guideline contemplated in the DEIS, much less the Adaptive Strategies or monitoring provisions, ensures that total old-growth acreage is tracked or that old-growth expansion will occur beyond areas where timber harvest is already precluded, such as Congressionally-designated wilderness.

The NOGA relies on structural metrics for old-growth definition, identification, and inventory. Although these definitions can be useful indicators of old-growth, they cannot also be assumed to be indicators of ecological integrity, including connectivity and the presence of species associated with old-growth. The Forest Service defines Ecological Integrity as:

The quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence (36 CFR 219.19)

An old-growth stand is much more than the minimum-threshold structural characteristics used for inventory and identification purposes. The Forest Service is well- aware that "[m]any forests with old-growth characteristics have a combination of higher carbon density and biodiversity that contributes to both carbon storage and climate resilience."51 Many species, including the Northern Spotted Owl, Northern Long-eared Bat, brook trout, pine marten, Cerulean Warbler, among others, are in decline and depend on old-growth conditions. The same can be said for many insects, plant species, and fungi.

The Forest Service has completely and arbitrarily failed to assess the past, present, potential, and desired species composition of old-growth forests across the US, including and in addition to tree species. This omission endangers the NOGA because the ecological integrity of old-growth is more than simply the structural characteristics of an old-growth stand.

What's more, the science is also clear that the quality and quantity of old-growth functions and values increase with patch size. 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 minimum 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 different ecological value than an old- growth stand within a larger matrix of contiguous old-growth forest. Vermont Fish and Wildlife's "Vermont Conservation Design" suggests that "4,000-acre minimum patch sizes are preferred" for old-growth management.52 The US Forest Service manages many of the largest contiguous blocks of forest in the Eastern US, including in New England. The Forest Service therefore has a unique opportunity and obligation to manage large forest blocks, comprising multiple contiguous stands, towards an old-growth condition, in addition to protecting all existing mature and old-growth stands, no matter their size or location.

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. DEIS DEIA Appendix 2 is a coarse baseline that establishes the expanse and broad-scale distribution of old-growth at the time of this DEIS comment period. A tracking mechanism should provide annual reports on increases and decreases in old-growth acreage by NFS unit, building on the aforementioned table in DEIA Appendix 2.

Second, as a way to provide public transparency and to assist with agency planning, the Forest Service must also produce a stand-level map that corresponds with DEIA Appendix 2, in contrast with the largely-meaningless and unhelpful fireshed-based mature and old-growth "heatmap" that was produced for the mature and old-growth inventory

(FS-1215a, April 2024). A detailed stand-level a 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 they do not go far enough. Within the 2012 Planning Rule, FSM 1921.03 - Policy instructs the agency to "Use available information pertaining to ecosystem composition, structure, function, and connectivity when developing plan components to contribute to ecological sustainability (36 CFR 219.8 (a), FSM 1921.5, and FSH 1909.12, ch.10 and 20)." No Alternatives in the NOGA DEIS consider or ensure old-growth ecosystem function, composition, and connectivity in any meaningful way.

The Forest Service must address these deficiencies in the NOGA DEIS by creating standards, guidelines, and monitoring requirements that pertain to the presence and viability of management indicator species and the connectivity of old-growth habitat at scales that are sufficient to sustain old-growth species and assemblages. To fail to address these components is not only a violation of the Purpose and Need, but risks reducing old- growth to little more than a set of structural characteristics, rather than a unique and complex ecosystem. Employing management indicator species as a metric for progress towards old-growth ecological integrity, abundance, and distribution is essential to ensure that the outcome of the NOGA meets the intent of the purpose and need and sustains the community of flora and fauna associated with old-growth forests in a given geography.

The NOGA must both protect and improve Forest Plan old growth standards

Neither the White nor Green Mountain National Forests contain standards that prohibit logging of old-growth trees, despite the fact that there is no scientific evidence justifying their removal for commercial or non-commercial reasons (see the Climate Forest Coalition comments, dated 9/19/24, for a rigorous discussion). If the NOGA is going to protect and recruit old-growth, it must contain a standard that prohibits the removal of

old-growth trees, regardless of the age of the surrounding stand. We recommend setting this threshold for tree-based protection at a maximum age of 141 years, which corresponds to the minimum stand age for identifying old-growth stands across most forest types in Region 9 (see Table 17, "Eastern Region old-growth community types, corresponding FIA forest types, and large tree diameter and density and stand age minima" in "Mature and Old-Growth Forests: Definition, Identification, and Initial Inventory on Lands Managed by the Forest Service and Bureau of Land Management. Fulfillment of Executive Order 14072, Section 2(b)").

Of course, old-growth is much more than just individual trees. This is already recognized by the White Mountain National Forest in Forest Plan Chapter 2: Forest-Wide Management Direction, Rare and Unique Features (p2-13), which contains standard S-3: "Timber harvest is prohibited in old growth forest" (emphasis added).

The DEIS notes that "If existing LMP direction provides more restrictive constraints on actions that may affect existing or potential old-growth forests, those more restrictive constraints would govern." We assume that means that the White Mountain National Forest standard mentioned above, and any other standards that are more restrictive than those contemplated in the Final ROD of the NOGA, will remain in place.

The NOGA must correct Forest Plan objectives that create incentives to log mature and old-growth trees and stands

Arbitrary age class management goals in Forest Plans, such as those in the White and Green Mountain National Forest plans, create perverse incentives that prevent the recruitment of old-growth conditions beyond areas that are outside of the suitable timber base. The NOGA DEIS entirely fails to address this significant contradiction in management direction, nor does it provide any protection for old-growth trees or stands.

The White and Green Mountain National Forests both define mature forests in their Forest Plans based on age thresholds (see tables on following page). The "Desired % range," as shown in the GMNF table, is indicative of how some Forest Plans require logging of mature and even old-growth stands to meet age class objectives. Such management incentives are contradictory to the goals and intent of EO 14072 and the National Old Growth Amendment. If these issues are not addressed by the Final ROD of the NOGA, the Forest Service's new policies will fail to account for one of the most important barriers to the retention and recruitment of old-growth.

Figure 1 - 2006 Forest Plan Age Classes, Green Mountain National Forest

Figure 2 - 2005 Forest Plan Age Classes, White Mountain National Forest
Conclusion

Executive Order 14072, "Strengthening the Nation's Forests, Communities, and Local Economies," commands the USDA Forest Service "to conserve America's mature and old-growth forests on Federal lands." To meet the intent of this EO, the Forest Service must correct course and implement a National Old Growth Amendment that protects mature and old-growth forests from their single greatest threat: logging.

Thank you for your careful consideration of these comments. Please don't hesitate to contact me with questions.

FOOTNOTES:

1 USFS, Telephone Gap Project Landscape Assessment 11 (July 2021) (hereinafter "TGIRP Landscape Assessment").

2 USFS, Forest Inventory and Analysis Program, Forest Inventory EVALIDator Web-Application Version 1.8.0.01.

3 Evans & Mortelliti, Effects of Forest Disturbance, Snow Depth, and Intraguild Dynamics on American Marten and Fisher Occupancy in Maine, USA, 33 Ecosphere e4027 (2022).

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8 Zaino et al., VERMONT CONSERVATION DESIGN - NATURAL COMMUNITY AND HABITAT TECHNICAL REPORT (2018)

9 Miller et al., Eastern National Parks Protect Greater Tree Species Diversity than Unprotected Matrix Forests, 414Forest Ecology & Management 74 (2018); Miller et al., National Parks in the Eastern United States HarborImportant Older Forest Structure Compared with Matrix Forests, 7(7) Ecosphere (July 2016); Faison et al., Adaptation and Mitigation Capacity of Wildland Forests in the Northeastern United States, 544 Forest Ecology

and Management 121145 (2023).

10 Zaino et al. (2018)

11 Watson et al., THE EXCEPTIONAL VALUE OF INTACT FOREST ECOSYSTEMS (2019)

12 DiMarco et al., WILDERNESS AREAS HALVE THE EXTINCTION RISK OF TERRESTRIAL BIODIVERSITY (2019)

13 Dinerstein et al. (2020)

14 Miller et al., EASTERN NATIONAL PARKS PROTECT GREATER TREE SPECIES DIVERSITY THAN UNPROTECTED MATRIXFORESTS (2018)

15 Miller et al., NATIONAL PARKS IN THE EASTERN UNITED STATES HARBOR IMPORTANT OLDER FOREST STRUCTURECOMPARED WITH MATRIX FORESTS (2016)

16 Canham et al 2013 - Regional variation in forest harvest regimes in the northeastern United States

17 Harris et al 2016. Attribution of net carbon change by disturbance type across forest lands of the conterminousUnited States. Carbon Balance and Management.

18 Davis, M.B. (ed.). (1996). Eastern old-growth forests. Prospects for rediscovery and recovery. Island Press: Washington, D.C.

19 Gunn et al 2013. Late-successional and old-growth forest carbon temporal dynamics in the Northern Forest(Northeastern USA). Forest Ecology and Management.

20 Duveneck and Thompson 2019. Social and biophysical determinants of future forest conditions in New England:Effects of a modern land-use regime. Global Environmental Change.

21 Ibid.

22 Ducey et al 2013. Late-Successional and Old-Growth Forests in the Northeastern United States: Structure,Dynamics, and Prospects for Restoration.

23 Ibid.

24 Keith et al., RE-EVALUATION OF FOREST BIOMASS CARBON STOCKS AND LESSONS FROM THE WORLD'S MOSTCARBON-DENSE FORESTS (2009).

25 Luyssaert et al., OLD-GROWTH FORESTS AS GLOBAL CARBON SINKS (2008).

26 Masino et al., OLDER EASTERN WHITE PINE TREES AND STANDS SEQUESTER CARBON FOR MANY DECADES ANDMAXIMIZE CUMULATIVE CARBON (2021).

27 Stephenson et al., RATE OF TREE CARBON ACCUMULATION INCREASES CONTINUOUSLY WITH TREE SIZE (2014).

28 Law et al, CHANGES IN CARBON STORAGE AND FLUXES IN A CHRONOSEQUENCE OF PONDEROSA PINE (2003)

29 Duveneck and Thompson (2019)

30 Keeton et al., Late-successional Biomass Development in Northern Hardwood-Conifer Forests of the NortheasternUnited States (2011)

31 Id.

32 Moomaw et al (2019). Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves theGreatest Good.

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34 Dinerstein et al., A GLOBAL SAFETY NET TO REVERSE BIODIVERSITY LOSS (2020).

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37 Underwood and Brynn, ENHANCING FLOOD RESILIENCY OF VERMONT STATE LANDS (2015)

38 Warren et al., FOREST STREAM INTERACTIONS IN EASTERN OLD-GROWTH FORESTS (2018).

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40 Thom et al., THE CLIMATE SENSITIVITY OF CARBON, TIMBER, AND SPECIES RICHNESS COVARIES WITH FOREST AGE INBOREAL-TEMPERATE NORTH AMERICA (2019)

41 Law et al., CREATING STRATEGIC RESERVES TO PROTECT FOREST CARBON AND REDUCE BIODIVERSITY LOSSES INTHE UNITED STATES (2022)

42 Zaino et al 2018

43 "The Critical Importance of Large Expanses of Continuous Forest for Bird Conservation" (Askins 2015)

44 Evans, B. E. and A. Mortelliti, "Effects of forest disturbance, snow depth, and intraguild dynamics on Americanmarten and fisher occupancy in Maine, USA." Ecosphere (2022) Vol. 13, Iss. 4.

45 Id.

46 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.

47 Id.

48 DEIS at S-6

49 Ibid

50 DEIS at 2

51 USFS Climate Adaptation Plan at 13

52 See Zaino et al 2018.

ATTACHMENT Comment re NOGA DEIS - Standing Trees - September 2024 - FINAL.pdf is Letter Text