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The Case for Protecting Both Old Growth and Mature Forests

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This paper presents an argument against two propositions: first, that the current level of old-growth forest is adequate, and second, that *if* we need to grow more old growth, we can wait for young forests to grow into old growth. The thesis of this paper is that there is a severe shortage of old-growth forests and to address this short-fall in a timely way, it is necessary to protect mature forests and trees because (a) they are already provide some values associated with old-growth forests and b) they are poised to become old growth more quickly. This paper also urges recognition that old-growth forests are part of a forest development continuum, and sound forest policy requires conservation of not just existing old growth but also the ecological processes that sustain and continuously recruit old growth.

> As recognized by [Forest Ecosystem Management Assessment Team], a conservation strategy for the Pacific Northwest must consider mature forests as well as [old growth]. Forests are considered to enter maturity when … they begin developing the characteristics that ultimately produce [old growth]. Mature forests serve various important ecologic functions. They serve as future replacements for old growth, help protect existing [old growth] by reducing the starkness of age-class boundaries, and provide landscape connectivity and transitional habitat that compensate to some degree for the low levels of [old growth]. Moreover, they are almost certainly more resistant to crown fires than younger forests, and hence contribute to buffering the landscape.[1]

David Perry, Emeritus Professor, Oregon State University, School of Forestry.

[1] Perry, D. 2008. Late-Successional and Old-Growth Forests in the Pacific Northwest. Statement of David A. Perry, Professor Emeritus. Department of Forest Science, Oregon State University, before the Subcommittee on Public Lands and Forests of the Committee on Energy and Natural Resources, United States Senate. March 13, 2008

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Instead of focusing on the fire-prone thicket in the back-ground, the Forest Service planned to log the fire-resistant mature trees marked in blue.

Executive Summary

1. “Save the Old Growth” is the banner under which people rally, but the real issue is to conserve old growth within the context of *healthy forest ecosystems*. This principle underlies thousands of pages of scientific reports that support the Northwest Forest Plan and Interior Columbia Basin Ecosystem Management Project. A political solution cannot succeed unless it is informed by and respects the complexity of ecosystems. Success requires protecting not just the old growth structures themselves, but also the ecological processes that create and maintain old growth. For example, forests must be allowed to grow, recruit new old growth trees, and die, thus recruiting new large snags and dead wood, and opportunities for new trees, all of which are just as essential to old growth ecosystems as are the big green trees.

2. It is clear there is not enough old growth; the surest and quickest way we can have more is to let mature forests grow old. Logging mature forests while relying on younger forests to replace old growth presents two risks. First, young forests will take decades longer to become old growth compared to mature forests. Second, we cannot be certain that young forests resulting from clearcutting will ever function as old growth because restoration methods are unverified. This uncertainty increases in the face of climate change.

3. The call for protection of mature forests and trees is not a radical new position. This is really just a more effective manifestation of the prime directive of the Northwest Forest Plan to grow more old growth and the Eastside Screens’ directive to protect all large trees. The only inconsistency with the NWFP is to reject the compromise that left one million acres of mature & old-growth forests unprotected. This compromise perpetuates conflict and delays ecosystem recovery that is ever more essential.

4. There is new urgency to protect mature forests to store carbon to mitigate climate change and to provide additional habitat as soon as possible to increase the chances that the spotted owls can co-exist with the invading barred owl.

5. While mature forests are growing into old-growth forests they'll provide important public values: habitat, watershed, carbon storage, recreation, and beauty. All the reasons for protecting old-growth forests also apply to mature forests because mature forests already provide some old-growth characteristics, and because they *are* future old growth.

6. Science tells us that while some degraded forests may benefit from logging, most natural forests will not benefit from logging. Developing policy that focuses and refines this distinction is a good way to help decide which forests need protection and which need active management.

7. Main point for the Westside: Don’t sacrifice the mature stands that are needed as recruitment as future old growth. Main point for the eastside: Don’t sacrifice co-dominant or medium-sized trees of fire-resilient species that are needed for recruitment of old forests and as habitat for species that depend on canopy cover and/or dead wood.

8. Recognize that any logging, even thinning mature stands or removing mature trees, will reduce the quality of habitat and delay attainment of old-growth characteristics such as snags and dead wood, which are defining characteristics of old growth and provide essential

ecological services, including fish & wildlife habitat, carbon storage, slope stability, and capture-storage-release of water and nutrients.

9. We should no longer tolerate “sacrifice areas” on public lands where commodity production overrides other important public values. Recognizing that non-federal lands provide all the wood fiber that society needs, the highest and best use of federal forests is to meet objectives that complement each other — biodiversity conservation, watershed protection, carbon sequestration, and compatible forms of recreation, instead of logging and other activities that are incompatible with these public values. This will require managing the *entire federal forest landscape* for ecological purposes — no more sacrifice areas.

10. Another aim is to temper unrealistic expectations about commercial timber production. There are a lot of dense forests, but many of them will not support commercially viable timber sales, especially in low productivity areas of the eastside. Public subsidies for low-impact equipment that can handle small diameter trees might be helpful, but subsidies must be very carefully targeted to ensure they lead to activities that do more good than harm.

11. Leaving mature forests unprotected will inhibit collaboration and perpetuate conflict over federal forest management.

Old-growth characteristics are degraded rather than enhanced by the logging of mature forests.

What is a "Mature" Forest?

After a major disturbance, forests develop through a sequence of many stages.[2] Maturity is the stage when forests start to develop the complexity that eventually manifests as classic old growth. According to the report of the Forest Ecosystem Management Assessment Team (FEMAT), the *mature seral stage* is "a time of gradually increasing stand diversity. Hiding cover, thermal cover, and some forage may be present."[3] The Northwest Forest Plan explained that "80 years is the age when many forest stands begin to develop late-successional characteristics, such as the formation of heavy limbs and an accumulation of coarse woody debris on the forest floor."[4] FEMAT and the Northwest Forest Plan did not distinguish old growth forests from mature forests. They used the term "late-successional forest" to describe the combined mature and old-growth seral stages.[5] These late successional forests collectively became the target of conservation and restoration.

> Structural characteristics of late-successional and old-growth forests vary with vegetation type, disturbance regime, and developmental stage. For example, in many Douglas-fir stands in western Oregon and Washington, the mature phase of stand development begins around 80 years and is characterized by relatively large live and dead trees, although multiple canopy layers may not yet be well developed.[6]

Mature trees are also developing characteristics that make them relatively resistant and resilient to fire compared to younger stands. These characteristics include: thick bark, high crowns, and high canopy cover that creates a cool, moist microclimate and provides shade to suppress the growth of ladder fuels.[7]

Mature seral stage begins with the "culmination of the mean annual increment" of growth (CMAI),[8] which means the age at which the average growth rate of a tree or stand first

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[2] Franklin J.F., Spies T.A., Van Pelt R., Carey A.B., Thornburgh D.A., Rae Berg D., Lindenmayer D.B., Harmon M.E., Keeton W.S., Shaw D.C., Bible K., Chen J., Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir forests as an example, For. Ecol. Manage. 155 (2002) 399-423. Van Pelt, R. 2007. Identifying Old trees and Forests in Washington. Washington DNR. http://www.dnr.wa.gov/ResearchScience/Topics/ForestResearch/Pages/lm_oldgrowth_guides.aspx

[3] USDA/USDI/NOAA/NPS/EPA. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Forest Ecosystem Management Assessment Team (FEMAT), Team Leader, Jack Ward Thomas. July 1993. Glossary, page IX-31.

[4] 1994 NWFP FSEIS, Appendix F-12. See also 1994 FSEIS Appendix B2, Ecological Principles for Management of Late-Successional Forest.

[5] 1994 NWFP FSEIS, Glossary p 9.

[6] 1994 NWFP FSEIS, Appendix B-44 (citations omitted).

[7] Franklin, J.F., D.A. Perry, R. Noss, D. Montgomery and C. Frissell. 2000. Simplified Forest Management to Achieve Watershed and Forest Health: A Critique. National Wildlife Federation, Seattle, Washington. http://www.coastrange.org/documents/forestreport.pdf

[8] FEMAT Glossary, p IX-31.

peaks (not the current growth rate, but the average growth rate), i.e., current increment of growth equals total growth divided by age.[9]

For Douglas-fir, the average age of (CMAI) is 85 years old. This varies depending on species, genetics, climate, soils, etc., but on *average* it's 85 years old.[10]

A note on terminology:

- "Mature and old-growth" is the same thing as "late-successional old-growth" or "LS/OG."[11] In this paper, the term "older forests" is also used to mean the same thing.
- "Large trees" are generally ≥20" diameter at breast height, however the ICBEMP team offers an important reminder that:

> Large trees is a relative term dependent on species and site. Large trees are a future source of large snags, and large snags are a future source of coarse woody debris, another important habitat component for many species. It is important to have present and **future sources of large trees** and snags at adequate levels though time.[12]

Conservation in Moist and Dry Forests

It is generally recognized among scientists and conservationists that forests with different disturbance regimes may need different forms of management.

In moist forests, with long periods between fires, management should focus on conserving entire stands of mature & old-growth forest because these forests are naturally dense.. Many species, including the spotted owl, marten, and fisher, depend on these dense forest conditions. Intervention is generally not needed to reduce drought stress or fire hazard in such stands. Because big and old trees are relatively rare and ecologically valuable wherever they occur, individual legacy trees should also be protected outside of older stands.

Dry forest ecosystems like those east of the Cascade crest differ significantly from moist forests to the west. Eastside forests grow in a more extreme climate—hotter and drier in summer and colder in winter—and often on less productive soils.[13] These forests are often less productive,

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[9] Tree Increment and Growth. http://sres-associated.anu.edu.au/mensuration/BrackandWood1998/T_GROWTH.HTM

[10] Curtis, Robert O. 1994. Some Simulation Estimates of Mean Annual Increment of Douglas-Fir: Results, Limitations and Implications for Management. USDA Forest Service PNW Research Station Research Paper PNW-RP-471.

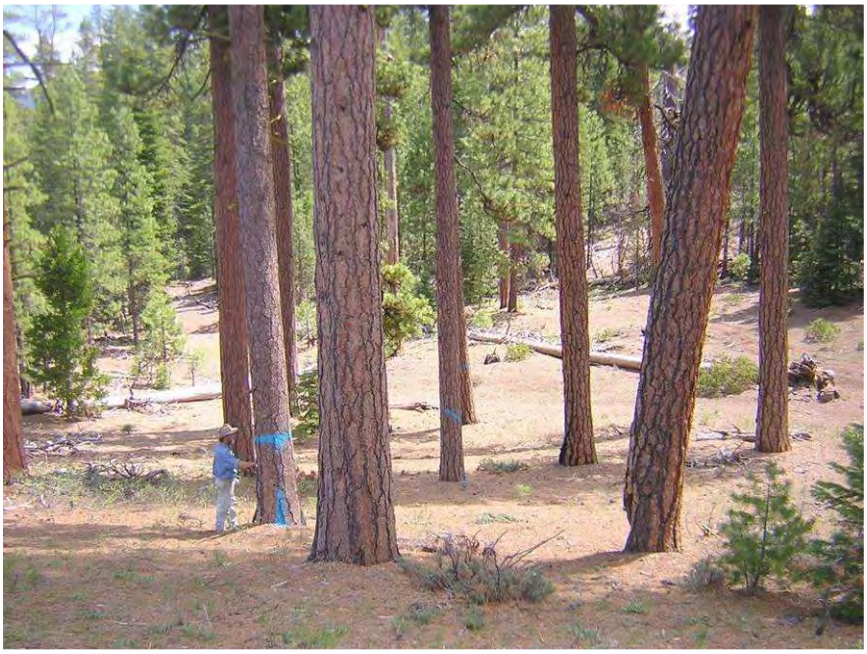
[11] 1994 NWFP FSEIS p 3&4-13.

[12] USDA/USDI 2000. Interior Columbia Basin Ecosystem Management Project (ICBEMP) SDEIS p 3-66 – 3-68.

[13] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf

more prone to drought stress, and were historically less dense due to the occurrence of frequent fires. Many species, like white-headed woodpecker, depend on these conditions. So, in dry forests with frequent fire return intervals, management should focus more on conserving individual mature and old trees, especially those that are fire-tolerant, early-seral species, like ponderosa pine, sugar pine, larch, white pine, and Douglas fir.

Though fire hazard is frequently overstated,[14] old forests in dry environments can suffer from the effects of fire suppression and may benefit from the removal of *small* fuels in order to protect rare large and old trees from fire and drought stress. This *exception* to the general principle that logging is inadvisable in older *stands* must be very cautiously implemented because research has shown that removal of commercial size logs can conflict with both fire hazard objectives and habitat objectives. Scientists have found that "treating more area of young, noncomplex forest reduced fire threat more effectively … than did treating structurally complex old-forest patches," and "requiring landscape treatments to earn a profit negatively impacted both habitat and fire objectives."[15] In some cases, forests may need to be maintained at higher than normal density levels in order to provide habitat for species like the northern spotted owl. For instance, the Final Recovery Plan for the Northern Spotted Owl states that recovery "may call for higher levels of dense late-successional and old forest than historically occurred in many dry forest landscapes."[16]



Fire resistant mature trees marked for cutting on the Fremont National Forest, Oregon

[14] Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's Forest Resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf

[15] PNW Research Station. 2006. Seeing The Bigger Picture: Landscape Silviculture May Offer Compatible Solutions To Conflicting Objectives. Science Findings. July 2006. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf

[16] FWS 2008. Final Recovery Plan for the Northern Spotted Owl, Appendix E: Managing for Sustainable Spotted Owl Habitat in Dry Eastern Cascades Forests of the Inland Northwest (from SEI 2008). p 111.

Mature forests logged under the Northwest Forest Plan. This is not restoration. It's just exploitation, slightly mitigated.

Here is a forest that could benefit from thinning and produce wood products.

Sensible thinning of young stands near existing roads on the Siuslaw National Forest.

Ecological Reasons to Protect Mature Trees and Forests

Our Guidepost: The Natural Range of Variability

> [M]anaging an ecosystem within its range of variability is appropriate to maintain diverse, resilient, productive, and healthy ecosystems for viable populations of native species. Using the historical range of variability ... is the most scientifically defensible way to meet society's objective of sustaining habitat.[17]

Recognizing the expected influence of climate change, many scientists now use the term "natural range of variability" instead of "historic range of variability" (HRV).[18]

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[17] Patrick Daigle and Rick Dawson. 1996. Extension Note 07 - Management Concepts for Landscape Ecology (Part 1 of 7). October 1996. http://www.for.gov.bc.ca/hfd/pubs/docs/en/en07.pdf; citing Swanson, F. J.; Jones, J. A.; Wallin, D. O.; Cissel, J. H. 1994. Natural variability--implications for ecosystem management. In: Jensen, M. E.; Bourgeron, P. S., tech. eds. Eastside Forest Ecosystem Health Assessment--Volume II: Ecosystem management: principles and applications. Gen. Tech. Rep. PNW-GTR-318. Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station: pp 89-106.

[18] Johnson, K.N., Duncan, S. 2007. THE FUTURE RANGE OF VARIABILITY: PROJECT SUMMARY. National Commission on Science for Sustainable Forestry. June 15, 2007.

Using the natural range of variability as a guide, current and future management should clearly emphasize efforts to restore and increase under-represented old forest types and should avoid creating more young forest types that are already over-represented. The Eastside Screens require protection of old-growth elements and movement toward the historic range of variability. When conducting activities in stands that are not considered old growth, "the intent is still to maintain and/or enhance LOS [late old structure] components in stands subject to timber harvest … [and to] manipulate vegetative structure that does not meet late and old structural (LOS) conditions … in a manner that moves it towards these conditions as appropriate to meet HRV."[19]

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) "found that the areas with the highest levels of traditional management [i.e., logging and grazing] had the highest departure in these characteristics [i.e., historic range of variability] and the highest probability of severe events."[20]

There is a severe region-wide deficit of mature and old-growth forest habitat in the Pacific Northwest.

Obtaining consistent estimates of the extent of old forests is always confounded by methodological differences in terms of time periods of interest, geographic scope, and definitions of old forest. Nevertheless, it remains undisputed that the northwest forest landscape was historically dominated by old forests, and that today the landscape is dominated by young forests.

The forest age-class distribution across the landscape was historically approximately one-third young forest and two-thirds mature and old-growth forest.[21] Today, after decades of intensive logging, the proportions of young and old forests across the landscape have been reversed - the current forest landscape is more than three-quarters young forest and less than one-fifth mature & old-growth forest.[22] (See figures below.[23]) The National Research Council (2000) discussed

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http://ncseonline.org/00/Batch/NCSSF/project_reports/NCSSF%20D3%20Johnson%20FRV%20Final%20Report%2006.16.07.pdf

[19] USDA Forest Service 1995. "Eastside Screens." Revised Interim Management Direction Establishing Riparian, Ecosystem And Wildlife Standards For Timber Sales. PNW Regional Forester's Forest Plan Amendment #2. 6/12/95. http://www.fs.fed.us/r6/uma/projects/readroom/pomeroy/school/seis/Appendix%20N%20Eastside%20Screens.pdf

[20] Quigley, T.M., and S.J. Arbelbide, *Technical Editors*. 1997. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins. PNW-GTR-405. vol I, p 47.

[21] FEMAT 1993. p IV-51 ("65% provides an estimate of the long term average percentage of the regional landscape covered by late successional forests."). See generally, NRC 2000 pp 67-72. Strittholt, J.R., D.A. DellaSala, and H. Jiang. 2006. Status of mature and old-growth forests in the Pacific Northwest, USA. Conservation Biology 20:363-374, and Appendix A of Randi Spivak's March 13, 2008 Congressional Testimony. http://www.americanlands.org/assets/docs/1205426522_Randi%20Spivak%20Senate%20Hearing%203%2013%2008%20Statement%20on%20Old%20Growth%20Final.pdf.

[22] NRC 2000, p 71; and Bolsinger, CL; Waddell, KL.1993. Area of old-growth forest in California, Oregon, and Washington. PNW-RB-197. USDA Forest Service. 1993.

the historic vs. current extent of "late-successional" (i.e., mature and old-growth) forests at some length and concluded that "regardless of the extent that old-growth forests might have increased or decreased naturally over thousands of years, the reduction of old-growth over the past century is a more abrupt change than the forests have undergone since the last ice age."[24]

Similar estimates have been made for both the dry eastside and moist westside forests. Cowlin (1942) estimated that in 1936 73% of eastern Washington and eastern Oregon was covered by older forests (after some logging had already occurred). Before logging began, old growth may have covered 86-90% of the landscape.[25] In the Oregon Coast Range, the mean percentage of old growth (>200 years old) was estimated at between 39 and 55 percent. The mean percentage of mature and old-growth forest combined showed less variation at between 66 to 76 percent.

Especially hard hit have been certain forest types like ponderosa pine and the oldest forest on the westside, as well as certain provinces like the Oregon Coast Range and the Puget Lowlands. Wimberly et al. (2000) noted that currently "the entire Coast Range province contains approximately 5% old growth and 11% late successional forests. These estimates fall far below the 5% quantiles for percent old growth and percent late successional forest modeled at the province scale."[26] Even with reduced logging levels, the Oregon Coast Range is not expected to recover from the effects of logging for more than a century. Nonaka and Spies (2005) conducted one of the most thorough province-level analyses ever and demonstrated that:

> a large number of landscape characteristics [in the Oregon Coast Range Province] are outside of HRV [historic range of variability]. Currently, forests <80 years old cover >75% of the landscape, whereas they historically occupied 21%, on average. The total core area of mature and older forests has decreased to about one twenty-seventh of the mean historical level. … The simulations indicated that 100 years was not long enough to return the overall condition of the landscape to the HRV under either scenario. First, the 100-year period was too short for old forests to reach the HRV. On the current landscape, the amount of forest older than 80 years is well below the historical level especially because old-growth forests (>200 years) are very rare.[27]

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[23] Graphs created with data from: McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon. (p 4-77).

[24] NRC 2000. p 67-72.

[25] Cowlin, R.W., Briegleb, P.A., and Moravets, F.L. 1942. Forest Resources of the Ponderosa Pine Region of Washington and Oregon. Misc. Publ. 490. Washington, DC: U.S. Department of Agriculture, Forest Service.

[26] Michael C. Wimberly, Thomas A. Spies, Colin J. Long, and Cathy Whitlock. 2000. "Simulating Historical Variability in the Amount of Old Forests in the Oregon Coast Range," Conservation Biology, Pages 167-180, Volume 14, No. 1, February 2000; http://www.fs.fed.us/pnw/pubs/journals/0010.pdf

[27] Nonaka, E., Thomas A. Spies. 2005. Historical Range Of Variability In Landscape Structure: A Simulation Study In Oregon, USA. Ecological Applications, 15(5), 2005, pp. 1727–1746.

Dry forests are also depleted. The report of the Eastside Scientific Societies estimates "that 15% of the original Ponderosa pine forest remains on the Eastside and less than 5% in the eastern Cascades and on Oregon's Klamath plateau. Continued logging of now unprotected LS/OG [late-successional old-growth] would further reduce the area occupied by these unique ecosystems …"[28] They also reported that:

> Log production from national forests in eastern Oregon and Washington increased nearly fourfold between 1949 and 1968. By the late 1960s, harvest from all lands, regardless of ownership, stood at 50% higher than the most optimistic estimate of sustained yield from eastside forests (Cowlin et al. 1942). … In summary, the forest landscapes of eastern Washington and Oregon have been transformed during the past century. Continued logging in unprotected areas could reduce LS/OG to less than 10% of the total forest area in the region, raising concerns about risks to species and ecological processes.[29]

The oldest forests are almost gone. "Current estimates of the extent of old-growth place it at less than half the lowest prelogging estimate. … Approximately 12 percent (3.6 million acres) of forest stands across Oregon are older than 160 years; and slightly fewer than 7 percent (1.9 million acres) are older than 200 years."[30] The National Commission on Science for Sustainable Forestry reported, "As of the mid-1990s, older forest in the Pacific Northwest dominated by trees more than 30 inches in diameter with complex forest canopies was estimated to comprise approximately 6 percent of forestland on all ownerships in western Washington, Oregon, and northern California - 3.5 million acres out of a total of 56.8 million. If the definition is broadened to include older forest with a mix of medium- and large-diameter trees and simple as well as complex canopies, that figure increases to about 21 percent."[31]

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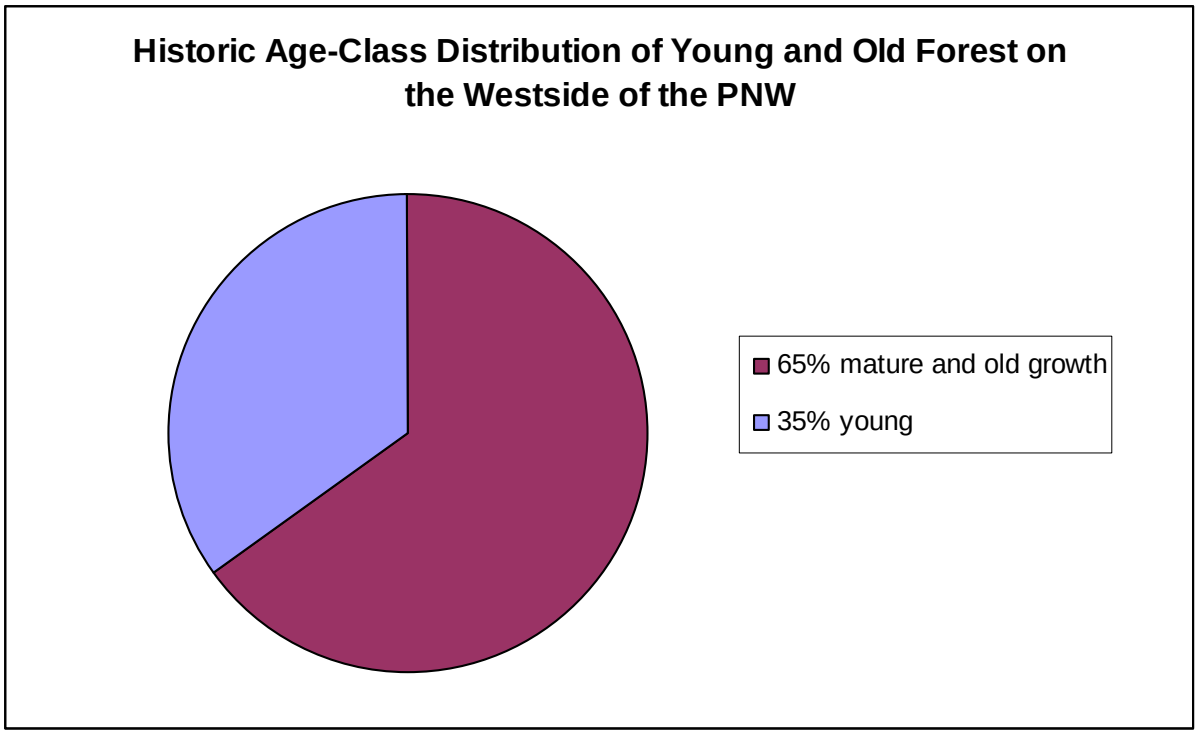
[28] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf

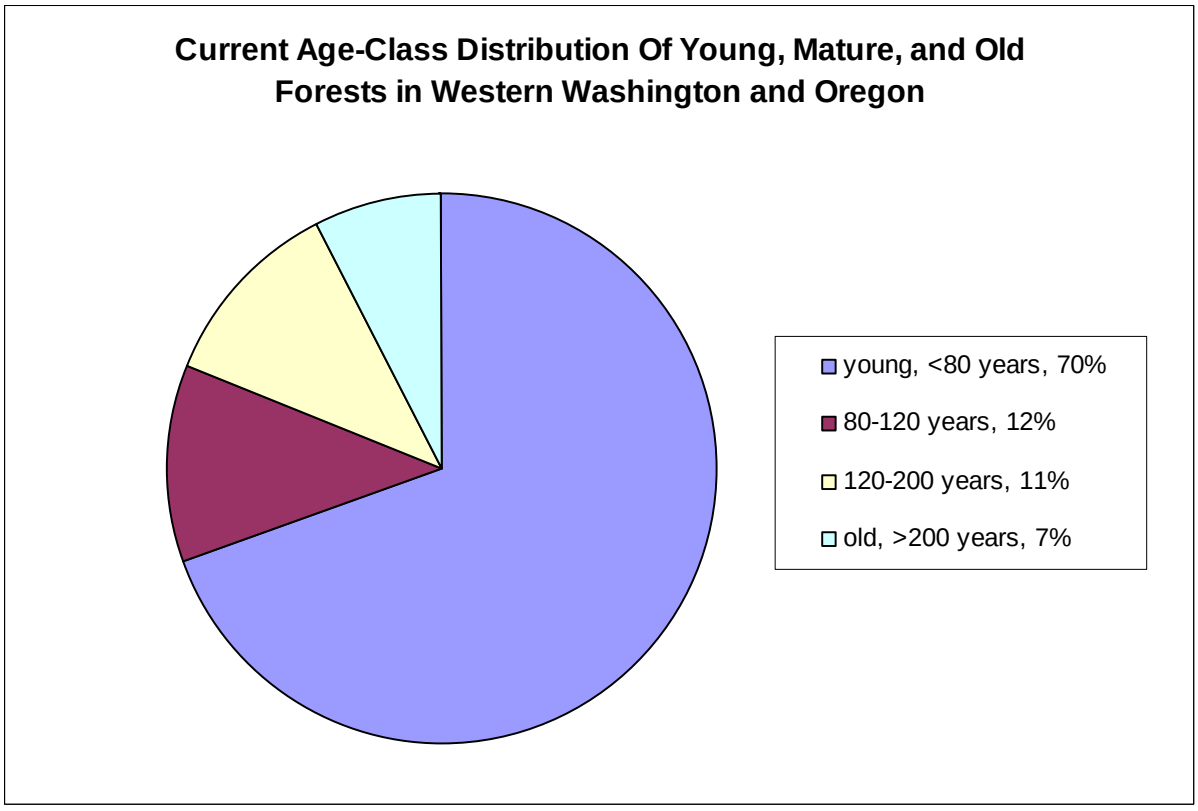
[29] Henjum (1994).

[30] Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's forest resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf. pp 36, 38.

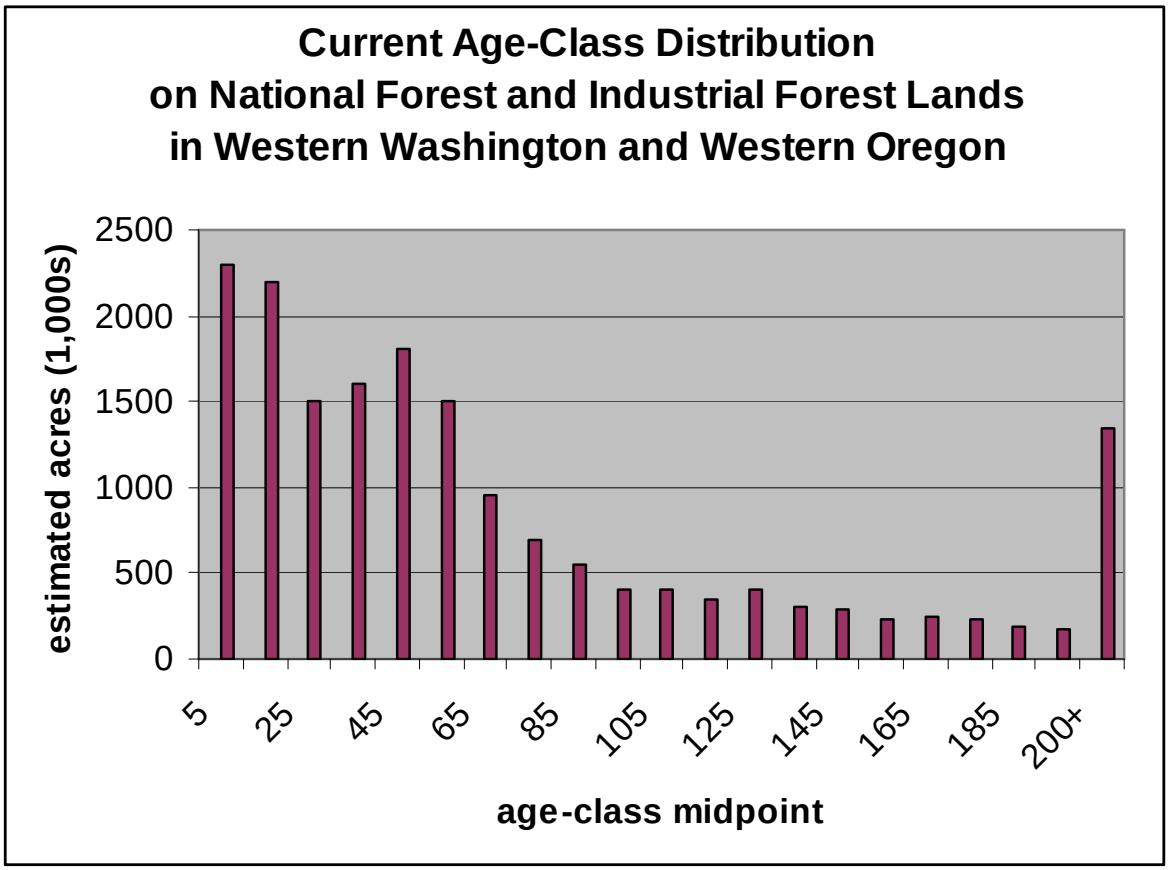
[31] NCSSF 2008. Beyond Old Growth Older Forests in a Changing World - A synthesis of findings from five regional workshops. National Commission on Science for Sustainable Forestry. http://ncseonline.org/00/Batch/NCSSF/BOG/OldGrowth_final%203.10.08.pdf



[Source: FEMAT 1993. p IV-51 ("65% provides an estimate of the long term average percentage of the regional landscape covered by late successional forests." (Late successional is defined as ≥80 years old).]



[Source: McShane et al. 2004. Evaluation report for the 5-year status review of the marbled murrelet.]



[Source: Evaluation report for the 5-year status review of the marbled murrelet. McShane et al. (2004.)]

If old-growth forests are to be restored and maintained, there must be continual recruitment into the pool of older forests.

There is widespread recognition among scientists, conservationists, and policy-makers that there is too little old growth and there needs to be more, but where will it come from? OSU's Gordon Reeves, who, as co-leader of FEMAT's Aquatics/Watershed Group, helped develop the NWFP Aquatic Conservation Strategy, asks "Where is the next generation of old-growth going to be and how will it develop? These questions are critical but they are not brought up in the current debate."[32] Jack Ward Thomas, Former Chief of the Forest Service and one of the chief authors of the Northwest Forest Plan writes that "plans must be developed and followed that will assure that new late successional forest habitats are 'on line' to replace the extant stands …. "[33]

Science no longer views late-successional forest ecosystems as static equilibrium systems. The old-growth seral stages are part of a dynamic continuum of forest development. A recent set of

[32] NCSSF/PNW Old Growth Workshop. Bonneville Hot Springs Resort. May 2005. http://www.fsl.orst.edu/Oldgrowthworkshop/statements/Reeves.pdf

[33] NCSSF/PNW Old Growth Workshop. Bonneville Hot Springs Resort. May 2005. http://www.fsl.orst.edu/Oldgrowthworkshop/statements/Thomas.pdf

scientific workshops on old-growth forest conservation conducted by the National Commission on Science for Sustainable Forestry concluded that:

> Mature stands that are nearly old growth also deserve protection. … To have old growth in the future, it's necessary to identify and protect or restore older forests that are nearing old-growth conditions… If the nation is serious about preserving biodiversity, older forest area must be increased. Such efforts must begin with the existing base of older forests, but it ultimately will be necessary to go well beyond this base to effectively meet biodiversity and human values goals. In every region, the full forest growth and development cycle needs to be integrated into old-growth restoration plans.[34]

"Using pre-settlement conditions as the reference point, eastern Oregon and Washington old forests currently are inadequately represented on the landscape. An old-forest conservation strategy could require that sufficient mature late-seral stands be developing into old-forest patches to meet this deficit." Given that all old forests will eventually be lost to stand replacing disturbance at some point in the future "conservation of the remaining old forests is the cornerstone of any management scheme … . [A]dditional old-forest stands need to continually be created to maintain a dynamic balance. … Any plan to sustain old forests must first sustain the landscape of which they are a part."[35]

> Sites that already have significant populations of old and/or mature trees provide the best opportunity for restoring sites to an approximation of historic old-growth forest structure, including dominance by old trees and spatially heterogeneous stands. … Managers intending to create sustainable old forest conditions should consider not only the conservation of existing large, old trees but also the need to provide for a flow of mature trees that can provide replacements for the old trees as they die.[36]

Mature forests often function as old growth.

It is important to recognize that old-growth characteristics "begin to develop" in mature stands, but more importantly that mature stands are more likely to contain some of the individual features such as big trees, snags, canopy layers, watershed protection, slope stability, and carbon storage that are already providing important values to wildlife and society. "Sites that do not have the full complement of old-forest characteristics can partially function as old forests for

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[34] NCSSF 2008. Beyond Old Growth Older Forests in a Changing World - A synthesis of findings from five regional workshops. National Commission on Science for Sustainable Forestry. http://ncseonline.org/00/Batch/NCSSF/BOG/OldGrowth_final%203.10.08.pdf

[35] Everett, R., P. Hessburg, J. Lehmkuhl, M. Jensen, and P. Bourgeron. 1994. Old Forests in Dynamic Landscapes: Dry-Site Forests of Eastern Oregon and Washington. Journal of Forestry 92: 22-25.

[36] Jerry F. Franklin, Miles A. Hemstrom, Robert Van Pelt, Joseph B. Buchanan. 2008. The Case for Active Management of Dry Forest Types in Eastern Washington: Perpetuating and Creating Old Forest Structures and Functions. Washington DNR. September 2008. http://www.dnr.wa.gov/Publications/lm_ess_eog_mgmt.pdf

those attributes that are present."[37] When old forests are in such short supply, these mature stands represent important "life boats" that will carry imperiled wildlife through the habitat bottleneck created by decades of overcutting.

The Northwest Forest Plan recognizes that "many mixed-age stands that include only scattered individuals or patches of old trees in a matrix of mature trees probably function ecologically much like classical 'old-growth' stands that have large numbers of old trees. ... [T]he terms 'late successional' and 'old growth' used in this Final SEIS include the successional stages defined as mature and old growth, both of which function as old growth. ..."[38] There is a significant risk that these mature-but-functionally-old-growth stands will be misidentified by the agencies and logged in pursuit of short-term economic goals.

Scientists urge protection of mature forests.

There have been several intensive and comprehensive scientific assessments concerning Pacific Northwest forests. Most notable were the Forest Ecosystem Management Assessment Team ("FEMAT" Report)[39] and the Interior Columbia Basin Ecosystem Management Project (ICBEMP),[40] both chartered by President Clinton after his 1993 Forest Summit. Other important reports were "Environmental Issues in Pacific Northwest Forest Management," prepared in 2000 by a distinguished committee of the National Research Council (NRC),[41] and the Report of the "Eastside Scientific Societies,"[42] which included the Society for Conservation Biology, the Ecological Society of America, and the Wildlife Society. All these reports recognize the importance of protecting mature, as well as old-growth, trees and stands. Dr. David Perry was a member of the NRC scientific panel, and has explained the differences between the FEMAT and NRC recommendations:

> The biological importance of mature forests (roughly 80-150 years old) was recognized by FEMAT, and the NRC panel agreed with their assessment. Basically, these are the next generation of old growth, and many are probably already developing aspects of OG [old growth] habitat. With remaining OG at

[37] Everett, R., P. Hessburg, J. Lehmkuhl, M. Jensen, and P. Bourgeron. 1994. Old Forests in Dynamic Landscapes: Dry-Site Forests of Eastern Oregon and Washington. Journal of Forestry 92: 22-25.

[38] 1994 NWFP FSEIS p 3&4-13.

[39] USDA/USDI/NOAA/NPS/EPA. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Forest Ecosystem Management Assessment Team (FEMAT), Team Leader, Jack Ward Thomas. July 1993.

[40] Integrated Scientific Assessment for the Interior Columbia Basin…. Thomas Quigley, ed., PNW-GTR-382, Sept 1996.

[41] National Research Council. 2000. Environmental Issues in Pacific Northwest Forest Management. Committee on Environmental Issues in Pacific Northwest Forest Management, Board on Biology, Commission on Life Sciences. Washington, DC: National Academy Press. http://books.nap.edu/openbook.php?isbn=0309053285

[42] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf

such low levels, the NRC panel felt that including forests on the cusp could make a significant difference in survival of some species over the next 100 years, and I would imagine that was the reasoning of FEMAT biologists as well.

The NRC panel departed from FEMAT in our beliefs that: from a conservation standpoint, all [old growth] and mature needed protection; and from an economic standpoint the region could afford to do that by reorienting harvests to younger forests. …

Protecting remaining OG is a big step in the direction of strengthening conservation. Protecting remaining mature is another one. Suppose the mature outside of reserves is logged. We then have two very distinct age classes in the region, old and young--nothing in between (outside of mature in reserves). From a demographic standpoint we run the risk of losing OG (to fire, wind, senescence) before enough young forests have reached OG stage to balance those losses. If that should happen, habitat that's already at the lowest level in history (so far as we know) becomes even lower. If it doesn't happen there's no problem. With the stresses that are going to be coming from climate change, the chances of it happening go up.

In the end I can only speak for myself, but I imagine many conservation ecologists would agree. The issue is risk, and how much insurance we can afford to buy to reduce risk. Protecting additional mature forests is buying insurance. Some argue that soft-touch logging such as green retention will effectively protect habitat for late-successional species (or create the conditions which allow that habitat to recover quickly). I think it would be great if it does, but the jury is out on that, and will be for some time to come.

On the other hand, there is an abundance of younger forest badly in need of thinning, and most of it could be commercial thinning that send logs to mills. I strongly believe the health of the [Pacific Northwest] forested landscape would benefit if those were the areas prioritized for logging.[43]

There is a similar need to protect and restore old forests and trees on the eastside of the Cascades. The ICBEMP scientists said:

> We had not anticipated the data indicating the extensive loss of large trees in the landscape over much of the Basin. The harvest legacy has been more extensive than we thought. … To maintain 'old growth' forests … timber harvesting practices will target smaller-diameter trees … and increase recruitment into old growth forests by accelerating growth rates of middle aged stands … through mechanically thinning the understory and using prescribed fires.[44]

[43] David Perry (Professor [emeritus], Oregon State University School of Forestry) correspondence to David Dreher (Legislative Assistant to U.S. Rep. Peter DeFazio), 15 June 2002.

[44] Integrated Scientific Assessment for the Interior Columbia Basin…. Thomas Quigley, ed., PNW-GTR-382, Sept 1996. pp 180, 168, 169.

The report of the Eastside Scientific Societies made the following recommendation:

> **Prohibit logging of dominant or co-dominant Ponderosa pine from any forest, regardless of whether the stand meets the criteria for LS/OG.** Protecting eastside forest ecosystems in the long term requires restoring ponderosa pine to its former dominance throughout much of the eastern Oregon and Washington. Remaining mature ponderosa pines, both inside and outside LS/OG areas, constitute important focal points for any recovery, serving as seed sources, reservoirs of genetic diversity, and refugia for other species. Species from mycorrhizal fungi to vertebrates like bald eagles and white-headed woodpeckers depend on old-growth ponderosa pine. Protecting ponderosa pine must be a high priority independent of the size of the patch where the trees are located.[45]

The Eastside Screens' 21" diameter limit leaves some ecologically valuable trees unprotected such as these blue-painted mature trees.

[45] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf (emphasis in original).

If mature forests are sacrificed, then ecosystem recovery will be delayed.

Too little old growth remains to ensure attainment of important policy objectives related to water quality improvement, recovery of threatened and endangered species, and carbon storage to mitigate climate change. Even if both mature and old-growth forests are protected, there will still be a significant shortage of old growth.

Nonaka & Spies (2005) suggested that "policy makers could use the relative rate and direction of the trend toward [historic range of variability] as one indicator for evaluating the differences between alternative biodiversity policies."[46] If we protect both mature and old growth, it will allow us to meet restoration goals sooner rather than later, and if we fail to protect mature forests, it will delay attainment of important policy objectives. When so many species are imperiled, with so many streams listed as water-quality limited, and carbon building in the atmosphere, we can't afford delay. Protecting mature stands helps achieve recovery sooner.

The reason that logging mature forest delays recovery of old growth is that once a mature forest or a mature tree is removed from the pipeline of stands on their way to becoming old growth, we have to wait for an even younger stand to grow and take its place. An effective solution must also include protection of recruitment habitat. We must protect both old growth and mature forests to solve the ecological problems we face.

The Northwest Forest Plan recognized the severe deficit of late-successional forests and called for extensive restoration of old forests over time[47], but the Northwest Forest Plan also involved an unfortunate political compromise that left one million acres of older forests unprotected, which delays recovery of the ecosystem and guarantees continuing conflict and controversy. If a timely recovery from the old growth deficit is to occur, all mature forests and trees must be protected so that they can become old-growth forests or be recruited to the dead wood pool, which serves other valuable functions in the forests.

Conservation of mature forest is needed as a hedge against the increased risk of disturbances caused by climate change.

Forest disturbance is closely correlated with large-scale climate patterns such as the El Niño/Southern Oscillation that will be modified by climate change. Climate change is expected to increase climate extremes such as winter storm events and droughts and thereby increase disturbances such as floods, wind, fire, and insects. Stand-replacing disturbances will truncate forest succession resulting in reduced average tree ages and reduced abundance of complex older forests— important ecological features that take a long time to replace. Therefore, conserving existing mature forests makes sense from two perspectives. First, mature forests are relatively

[46] Nonaka, E., Thomas A. Spies. 2005. Historical Range Of Variability In Landscape Structure: A Simulation Study In Oregon, USA. Ecological Applications, 15(5), 2005, pp. 1727–1746.

[47] USDA FS. 1998. Old Growth Forest Vegetation http://web.archive.org/web/20030402090844/http://www.fs.fed.us/land/fm/oldgrow/oldgrow.htm ("Of the land that is considered forested (16.4 million acres), 52 percent is currently in a large-tree or old-growth condition. The plan projects an increase to 73 percent over the long-term.")

resilient to disturbance,[48] so we can mitigate climate stress by increasing the fraction of the landscape covered by resistant/resilient older forests. Second, retaining "extra" mature forests in the current time period can help mitigate the expected future loss of forests due to climate stress. Because we are starting with a larger baseline of older forests, it will take longer to erode the baseline, giving us more time to address the climate problem.

As pointed out by OSU's Tom Spies, "Where stand-replacement disturbances occur at frequencies that are less than about half the age at which tree species of a forest reach maturity, old-growth conditions will be uncommon or rare in the landscape (Spies and Turner 1999). For example, taking the fire frequency– age class model of Van Wagner (1978), old-growth would be less than 10 percent, on average, in a landscape with a disturbance frequency of 50 years and forests that require 150 years to develop into old-growth."[49] We don't yet know the location or extent of the landscape that will be affected by climate-driven disturbance, but the consequences of increased climate-driven disturbance are alarming and support a call for greater conservation of existing mature forests.

In addition to stand-level and landscape-level disturbance, there may be smaller-scale climate effects at work. Recent research indicates a disturbing trend toward increased mortality in individual trees in older forests across the west. In the Pacific Northwest, tree mortality rates in older forests have increased from 0.3% in the 1970s to 1.3% today.[50] This study was not based on a random sample of sites, so extrapolation is difficult, but if this trend holds true and continues, older forests will need to be replaced by mature forests even sooner. Retaining populations of mature forests and larger trees that are well distributed across the landscape will increase the likelihood that the late-successional forest deficit doesn't worsen.

Mature forests are needed to store carbon to mitigate global warming.

Mature forests and fire-tolerant large trees are a secure and robust form of carbon storage that can help mitigate climate change. Maximizing our forests' capacity to sustainably store carbon to reduce and mitigate climate change must be a primary motivation for forest conservation and restoration. Fortuitously, forest carbon storage is highly complementary with societal objectives for clean water, wildlife, and recreation.

If protected, mature forests will continue growing and removing carbon from the atmosphere for decades.[51] Mature forests have not yet reached their full potential for carbon storage, because

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[48] Franklin, J.F., D.A. Perry, R. Noss, D. Montgomery and C. Frissell. 2000. Simplified Forest Management to Achieve Watershed and Forest Health: A Critique. National Wildlife Federation, Seattle, Washington. http://www.coastrange.org/documents/forestreport.pdf

[49] Spies, T.A. 2004. Ecological Concepts and Diversity of Old-Growth Forests. Journal of Forestry. April/May 2004.

[50] van Mantgem, P. J., Stephenson, N.L., et al. Widespread Increase of Tree Mortality Rates in the Western United States. Science 323, 521-524 (2009).

[51] Oregon Wild. 2008. "The Straight Facts on Forests, Carbon, and Global Warming" http://tinyurl.com/2n96m5. Luyssaert, et al. 2008. Old-growth forests as global carbon sinks. Nature Vol 455. 11 September 2008. Smithwick EAH, Harmon ME, Acker SA, Remillard SM. 2002. Potential upper bounds of carbon stores in the Pacific Northwest. Ecological Applications 12(5): 1303-1317. Harmon, M., Ferrell, W., and J. Franklin. 1990. Effects on Carbon Storage of Conversion of Old-Growth to Young Forests. Science. 9 February 1990. Harmon, Harmon,

they still have a lot of growing to do, and they will continue to sequester additional carbon in both wood and soil for a long time. Old-growth forests in the moist "westside" portions of the Pacific Northwest apparently store more carbon per-acre than any other forests in the world.[52]

A report recently released by The Wilderness Society stated:

> "Mature and old growth forests can store or sequester extraordinary amounts of carbon, such as in the forests of the Pacific Northwest," said Dr. Jerry F. Franklin, a Professor with the University of Washington's College of Forest Resources. "An analogy would be that older forests can be viewed as having very large capital reserves, whereas younger forests have high cash flow, or carbon uptake, but contain very little capital, such as sequestered carbon. There's also a high 'transaction cost' when you 'liquidate' this stored carbon by harvesting the forest. The harvested sites are significant carbon sources leaking carbon dioxide to the atmosphere for many years to decades following the harvest."[53]

Logging mature forests will exacerbate global warming because mature forests already store substantial amounts of carbon, a large fraction of which would be transferred to the atmosphere if logged. Mature forests cannot be converted to young forests or wood products without losing the vast majority of carbon to the atmosphere. In the century preceding 1990, converting vast areas from old growth to plantations on the westside of Oregon and Washington caused 100 times more carbon emissions from land-use activities compared to the global average for similar sized areas.[54] Of the vast amount of carbon removed from forests via timber harvest in Oregon and Washington from 1900 to 1992, only 23% is contained in forest products (including landfills); the other 77% has been released to the atmosphere; so, for every ton of wood-based carbon in our houses and landfills, there is another 3 tons in the atmosphere.[55]

Ferrell and Brooks. Modeling Carbon Stores in Oregon and Washington Forest Products 1900-1992. Climate Change 33:521-550 (1996).). Law, B.E., Turner, D., et al 2004. Disturbance and climate effects on carbon stocks and fluxes across Western Oregon USA. Global Change Biology (2004) 10, 1429-1444.

[52] Smithwick EAH, Harmon ME, Acker SA, Remillard SM. 2002. Potential upper bounds of carbon stores in the Pacific Northwest. Ecological Applications 12(5): 1303-1317. "The C densities we measured in old-growth forests of the PNW are higher than C density values reported for any other type of vegetation, anywhere in the world. … Results showed that coastal Oregon stands stored, on average, 1127 Mg C/ha, which was the highest for the study area, while stands in eastern Oregon stored the least, 195 Mg C/ha. … the highest C density was at stand CH04 at Cascade Head, ORCOAST, with 1245 Mg C/ha."

[53] Ingerson, Ann L. 2007. U.S. Forest Carbon and Climate Change. The Wilderness Society. Washington, D.C. http://wilderness.org/files/ForestCarbonReport_0.pdf

[54] Harmon, M., Ferrell, W., and J. Franklin. 1990. Effects on Carbon Storage of Conversion of Old-Growth to Young Forests. Science. 9 February 1990.

[55] Harmon, Harmon, Ferrell and Brooks. Modeling Carbon Stores in Oregon and Washington Forest Products 1900-1992. Climate Change 33:521-550 (1996).

In fact, logging virtually always results in a net loss of carbon to the atmosphere.[56] Contrary to popular belief, even fuel-reduction logging comes with a cost in terms of net carbon emissions, because, the cumulative effects of logging across the landscape to reduce fire hazard ends up removing more carbon from the forest than fire does.[57]

It is time to draft northwest forestlands in the effort to save the climate. Forests in Washington, Oregon, and California store a disproportionate share of the nation's carbon stocks. West coast forests represent only about 20% of U.S. forested landscape, but they hold about 40% of the United States' total stock of forest carbon. It is estimated that if these forests were allowed to grow and return to historical levels of old-growth across the landscape, Pacific Northwest forests could store two to three times more carbon than they currently store. Considering that the net carbon sink provided by the nation's forests already offsets over 10% of all annual U.S. CO_2 emissions, allowing forests in the Pacific Northwest to return to old-growth conditions could play a significant role in helping to mitigate climate change.

A carbon-rich mature forest in SW Oregon on BLM lands slated for logging. Logging such stands will terminate carbon accumulation and accelerate carbon emissions.

[56] Oregon Wild. 2008. Climate Control – How NW Old Growth Forests Can Help Fight Global Warming. http://www.oregonwild.org/oregon_forests/global-warming-and-northwest-forests, and see this slideshow which clarifies the relationships between forests, carbon and climate: http://www.slideshare.net/dougoh/forest-carbon-climate-myths-presentation/

[57] Mitchell, S., Harmon, M., and O'Connell, K. (in Review) Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. Ecological Applications. http://ecoinformatics.oregonstate.edu/new/FuelRedux_FS_CStorage_Revision2.pdf

Mature forests are needed for climate change adaptation.

Global warming is expected to force significant changes in western forest ecosystems, and in order to continue to receive the tremendous ecosystem services that we enjoy from forests, our forests must be able to respond.[58] Mature and old-growth forests are critical components of an effective adaptation strategy for climate disruption. "Diversity is essential to adaptability"[59] and mature and old-growth forests are reservoirs of biodiversity and core habitat for countless species. Each species and each biotic community is a record of successful adaptation to past changes. Mature and old-growth forests are relatively more resilient than younger forests and are able to resist and recover from disturbances. Logging and road building increase fragmentation, which in turn will harm the ability of wildlife to move into more suitable habitat in a warming climate.

Mature forests may be among the last ecosystems to succumb to climate change, because mature forests exhibit "ecological inertia"— creating conditions suitable for their own persistence, like thick bark, deep roots, high canopies, moist microclimate, and complex soil foodweb and nutrient cycles. Younger forests (on both federal and non-federal lands) are more vulnerable to climate change, because young forests have shallow roots that can't reach deep soil water reservoirs; they have relatively thin bark and interlocking branches close to the ground which makes them vulnerable to fire; they lack the deep multi-layered canopies that create cool-moist microclimate; and the soil foodweb is less tightly coupled so the system is more likely to leach nutrients.

Also, most northwestern tree species are at least somewhat tolerant of extremes because forests in this region generally experience wet winters and dry summers on an annual basis. Trees that live for many hundreds of years persist through a lot of climate variations, including wet decades and dry decades driven by ocean conditions and numerous hundred-year floods and hundred-year droughts. These long-lived trees seem able to tolerate extremes at many scales. Trees that have survived several extreme events may be able to survive a few more.

A recent OSU study lends further support to the resiliency of old trees. It found that slower-growing older trees tend to channel relatively more of their energy into structural support and defense compounds to "maximize durability while minimizing … damage".[60]

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[58] Oregon Wild. 2008. "The Straight Facts on Forests, Carbon, and Global Warming" http://tinyurl.com/2n96m5.

[59] Bormann, Bernard T.; Brookes, Martha H.; Ford, E. David; Kiester, A. Ross; Oliver, Chadwick D.; Weigand, James F. 1994. Volume V: a framework for sustainable-ecosystem management. Gen. Tech. Rep. PNW-GTR-331. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 61 p. *in* Everett, Richard L., Assessment Team Leader; Eastside Forest Ecosystem Health Assessment. http://www.fs.fed.us/pnw/publications/pnw_gtr331/pnw_gtr331b.pdf

[60] Colbert, & Pederson. 2008. Relationship between radial growth rates and lifespan within North American tree species. Ecoscience 15(3), 349-357 (2008). http://www.ecoscience.ulaval.ca/catalogue/FA3149-black.pdf

Mature forests provide essential habitat for imperiled species that society is most concerned about.

One of the primary bases for the National Research Council recommendation to protect "most or all of the remaining late successional and old-growth forests" was their recognition that "further cutting of the remaining late successional and old growth forests of the Pacific Northwest is expected to cause rapidly accelerating threats to the biological diversity of the region. … To prevent extinction, viable populations must be managed."[61] Such species include threatened northern spotted owls, marbled murrelets, Pacific salmon, as well as many "survey and manage"[62] species that perform essential ecosystem services like nitrogen fixation and nutrient cycling.

Modeling by OSU's Gordie Reeves "indicates that intermediate-aged forests (120-160 years old), not very old or very young forests, may provide the most productive and diverse fish habitat."[63] Presumably this model describes a system that cycles through all age classes and retains the legacy structural features of older stands.

Spotted owls rely on mature as well as old-growth forests. "Nesting, roosting, and foraging functions [for northern spotted owl] are provided by sub-mature, mature, and old-growth forest types in eastern Washington."[64] Recent range-wide data analysis by Carlos Carroll and Devin Johnson attempts to control for survey bias caused by spatial autocorrelation of owl sites (e.g., juveniles owls are not randomly distributed by tend to live near their parents). Their findings corroborate the long-standing relationship between spotted owls and old growth forests, and shows that the models that best explain the abundance of spotted owl sites include both mature (50-150 y/o) and old growth (>150 y/o) forests.

> A quadratic model based on the combined proportion of old-growth and mature forest … showed the lowest DIC [deviance information criterion] in the southern subregion (northwestern California and southwestern Oregon) (Fig. 1). In the central (northern Oregon) and northern (Washington) sub-regions, the best model contained a pseudo-threshold relationship between owl site abundance and the proportion of old-growth and mature forest… In all subregions the coefficient for old-growth was greater than that for mature forest, and this contrast increased from the southern to northern subregion … [T]he quadratic inflection in the model for the southern subregion occurred in landscapes with 95% old-growth and mature forest, it effectively portrays a threshold relationship at levels of greater than 80% old-growth and mature forest … Within the central and northern subregions, no such threshold is evident from our results because owl abundance was

[61] NRC 2000, pp 5, 6, 104.

[62] http://www.blm.gov/or/plans/surveyandmanage/index.htm

[63] INR 2008. Nonequilibrium Ecosystem Dynamics: Management Implications for Oregon. Institute for Natural Resources, October 13, 2008. http://www.oregon.gov/ODF/RESOURCE_PLANNING/docs/NonequilibriumEcosystemDynamics.pdf

[64] Jerry F. Franklin, Miles A. Hemstrom, Robert Van Pelt, Joseph B. Buchanan. 2008. The Case for Active Management of Dry Forest Types in Eastern Washington: Perpetuating and Creating Old Forest Structures and Functions. Washington DNR. September 2008. http://www.dnr.wa.gov/Publications/lm_ess_eog_mgmt.pdf

> predicted to continuously increase with increasing proportion of old-growth and mature forest."[65]

The lesson seems to be, "mature forests are good for spotted owls and as it grows older it will get better." If policy encourages harmful logging of mature forest, then conflicts with the Endangered Species Act (ESA) become likely.

Several ESA-listed species rely on mature forests in the Oregon Coast Range Province where "many of the remaining natural forests consist of a mosaic of mature stands and remnant patches of old-growth trees. Because it is isolated and large areas have been harvested, the Oregon Coast Range Province is of concern for northern spotted owls, marbled murrelets, and anadromous fish."[66]

Spotted owls subsist on a diet of mostly small mammals, many of which live in mature forests. While mature forests may not provide ideal spotted owl *nesting* habitat, they do provide excellent *foraging* opportunities and provide *thermal refugia* during hot and cold periods. If we protect old-growth and not mature, it will be like saving the owls' bedroom but destroying their pantry. "Mature forest fragments provide truffles and other food for small mammals such as red-backed voles during the dry summer months when such food is unavailable in plantations."[67] "Coarse woody debris is essential for many species of vascular plants, fungi, liverworts, mosses, and lichens. Truffle production is associated with coarse woody debris in mature forests in southwestern Oregon. This is probably related to the moisture-holding capacity of decayed wood in comparison to surrounding soil that dries and suppresses fruiting of fungi."[68]

Threatened marbled murrelets also rely on mature forests. "Suitable murrelet nesting habitat has been tentatively defined as old-growth forests, and mature forests with an old-growth component ...."[69]

The 1997 Final Recovery Plan for the Threatened marbled murrelet urges protection of both old-growth and mature forests:

> Consistent with the Forest Plan Record of Decision, thinning within Late-Successional Reserves should be restricted to stands younger than 80 years. ... [Recovery Action 3.2.1.2] **Protect 'recruitment' nesting habitat** to buffer and enlarge existing stands, reduce fragmentation, and **provide replacement habitat** for current suitable nesting habitat lost to disturbance events. Stands (currently 80 years old or older) that will produce suitable habitat within the next few decades are the most immediate source of new habitat and may be the only replacement

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[65] Carlos Carroll and Devin S. Johnson. (In press) The Importance of Being Spatial (and Reserved): Assessing Northern Spotted Owl Habitat Relationships with Hierarchical Bayesian Models. Conservation Biology.

[66] 1994 NWFP FSEIS p 3&4-21.

[67] 1994 NWFP FSEIS p 3&4-31.

[68] 1994 NWFP FSEIS p 3&4-32.

[69] 1994 NWFP FSEIS p 3&4-236.

> for existing habitat lost to disturbance (e.g., timber harvest, fires, etc.) over the next century. Such stands are **particularly important because of the vulnerability of many existing habitat fragments to fire and wind and the possibility that climate change will increase the effects of the frequency and severity of natural disturbances**. Such stands should not be subjected to any silvicultural treatment that diminishes their capacity to provide quality nesting habitat in the future. Within secured areas, these "recruitment" stands should not be harvested or thinned.[70]

In the summer of 2008 the Bush Administration issued a Final Recovery Plan (FRP) for the Threatened Northern Spotted Owl.[71] Although this plan is scientifically and legally flawed in some respects,[72] the FRP nonetheless recognizes the value of conserving and restoring *mature*—not just old-growth—forests:

- "Scientific research and monitoring indicate that spotted owls generally rely on **mature** and old-growth forests because these habitats contain the structures and characteristics required for nesting, roosting, and foraging." [73] (emphasis added)
- "In the Western Washington Cascades, spotted owls roosted in **mature forests** ... . In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and **mature forests** for foraging and roosting and used young forests less than predicted based on availability..." (FRP p 52, emphasis added).

In regard to dry forest types, the Final Recovery Plan for the northern spotted owl recognizes the value of conserving and restoring mature trees (and smaller size classes) in order to provide recruitment and canopy cover:

- "Active management in dry forests primarily concerns restoring sustainable ecological conditions, with significant populations of **intermediate-sized** and large trees throughout. **Mature** and old trees will provide the framework for **replacement spotted owl habitat when suitable habitat patches are lost to fire**. ..." (FRP p 22, emphasis added).
- "**Smaller size classes** of fire tolerant species **provide the recruitment resource** for future large and very large fire tolerant trees." (FRP pp 23, 109, emphasis added).
- "**Decreasing crown density is the least important of all other [fire resilience] principles are applied**. This principle may be applied variably across the landscape and

[70] FWS. 1997. Recovery Plan For The Threatened Marbled Murrelet (*Brachyramphus Marmoratus*) In Washington, Oregon, And California. http://ecos.fws.gov/docs/recovery_plans/1997/970924.pdf (emphasis added).

[71] USDI Fish & Wildlife Service. 2008. Final Recovery Plan for the Northern Spotted Owl. http://www.fws.gov/pacific/ecoservices/endangered/recovery/NSORecoveryplanning.htm.

[72] A coalition of conservation organizations is challenging the recovery plan and revised critical habitat in court.

[73] USDI/FWS 2008. Final Recovery Plan for the Northern Spotted Owl, page VII (emphasis added) (hereinafter FRP).

would appropriately be ignored in owl habitat to **maintain prey habitat and provide closed canopy owl habitat**." (FRP p 109, emphasis added).

- "[S]tand restoration and fuel treatment principles: …

  > Retain the **large** and very large fire tolerant trees—existing old trees of fire tolerant species (ponderosa pine, western larch, Douglas-fir, sugar pine, incense-cedar, Jeffrey pine, and a few others depending on location) should be **retained throughout the landscape** managed for Northern Spotted Owl habitat. These trees take 150 or more years to grow and are **not easily replaced**. They are key habitat features that can persist for centuries. Large trees of other species (e.g., grand fir and white fir) and younger, smaller trees (e.g., <20" DBH) of fire tolerant species may be removed outside critical owl habitat to reduce canopy fuels. The panel recommends … recognition of **old trees regardless of diameter** (FRP p 110, emphasis added).

- "[C]onsiderations to aid in landscape planning for sustainable Northern Spotted Owl habitat … High quality habitat should be identified and fuels management and other restoration treatments should be applied adjacent to high quality habitat to reduce fire risks while maintaining **medium** and large tree structure and favoring fire tolerant tree species." (FRP pp 111-112, emphasis added).
- In Eastern Cascades and California Cascades Provinces, "In moist forests within spotted owl habitat capable areas, management should **focus on thinning stands created by past harvest** or fire in order to accelerate the development of large tree structures." (FRP p 23, emphasis added).
- "The key ingredients in all management to produce, conserve, or protect dry east-side old forest is the **retention or generation of sufficient numbers of large and** very large, old ponderosa pine, western larch, and (in some cases) Douglas-fir and the maintenance of both meso- and fine-scale patchiness among and within stands." (FRP p 107); and
- Outside of high quality owl habitat patches "maintain structural conditions supporting prey occurrence and abundance in current or potential [nesting, roosting and foraging] habitat, maintain structural conditions conducive to Northern Spotted Owl foraging, and allow for rapid development of replacement [nesting, roosting and foraging] habitat." (FRP pp 112-113). Spotted owls and their prey benefit from abundant dead wood, but thinning removes significant amounts of wood from the dead wood recruitment pool, so thinning in mature forests is inconsistent with this element of the recovery plan.

The main point here is that any effort to encourage potentially harmful logging in mature forests could place imperiled species at greater risk. In the exceptional circumstances where dry mature forest may need to be treated to improve resilience, the focus must be on the surface and ladder fuels. The canopy trees must remain intact.

There is an urgent need to increase owl habitat to increase the chances that spotted owls can co-exist with invading barred owls.

Barred owl competition and displacement are significant concerns emerging in the status review for the northern spotted owl. The 2004 spotted owl status review panel unanimously identified

barred owls as a future threat to the spotted owl.[74] A well-known axiom from island biogeography holds that as habitat area increases, the number of cohabiting species also increases.[75]

> The major causes of population and species extinction worldwide are habitat loss and interactions among species. … The most robust generalization that we can make about population extinction is that small populations face a particularly high risk of extinction. … [E]mpirical support for the extinction-proneness of small populations has been found practically wherever this issue has been examined. … The loss of habitat reduced population size …. Larger habitat patches have larger expected population sizes than smaller patches. Therefore, other things being equal, we could expect large habitat patches to have populations with a lower risk of extinction than populations in small patches. …[76]

From these ecological foundations, one can see that the barred owl, by invading and occupying suitable habitat and excluding spotted owls, has reduced the effective size of the reserves that were established by the Northwest Forest Plan. This effectively reduces the potential population of spotted owls. Extinction risk is increased by this loss of available habitat and smaller population. If we provide more suitable habitat by protecting mature forests, the population potential increases, and the risk of extinction decreases. The most rational way to respond to the invasion of the barred owl is to protect all remaining suitable habitat, and expand and restore the reserve system to provide more suitable habitat, which will increase the likelihood that the two owl species can co-exist.

This view is corroborated by owl biologist David Wiens who was interviewed on the Lehrer NewsHour and said: "The more habitat you protect, the more you're going to alleviate the competitive pressure between the species. Rather than reducing it and increasing the competitive pressure between these two species, we need to *provide as much habitat as possible* for them."[77] Biologist Robert Anthony agrees: "If you start cutting habitat for either bird, you just increase competitive pressure." And in the same news story Eric Forsman added: "You could shoot barred owls until you're blue in the face," he said, "but unless you're willing to do it forever, it's just not going to work."[78] Mature forests provide suitable habitat for spotted owls and is urgently needed to help the owl persist in the face of this new threat.

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[74] Gutierrez. R. 2004. THREATS: Past, Present, and Future, slide presentation. http://www.sei.org/owl/meetings/Presentations/June/Gutierrez-Threats.pdf

[75] Tilman, D. and P. Karieva, Eds. 1997. Spatial Ecology: The Role of Space in Population Dynamics and Interspecific Interactions. Monographs in Population Biology, Princeton University Press. 368 pp. See especially, Part III – "Competition in a Spatial World."

[76] Oscar E. Gaggiotti and Ilkka Hanski. 2004. Chapter 14 - Mechanisms of Population Extinction. In Ecology, Genetics, and Evolution of Metapopulations. Elsevier. 2004. http://www.eeb.cornell.edu/sdv2/Readings/Gaggiotti&Hanski.pdf

[77] WIENS, D. 2007. NewsHour interview. "Biologists Struggle to Save the Spotted Owl." December 18, 2007. http://www.pbs.org/newshour/bb/science/july-dec07/owl_12-18.html

[78] Welch, Craig. 2009. The Spotted Owl's New Nemesis. Smithsonian Magazine. January 2009. http://www.smithsonianmag.com/science-nature/The-Spotted-Owls-New-Nemesis.html?c=y&page=2

The 2008 Final Recovery Plan (FRP) for the Northern Spotted Owl has partially addressed the barred owl issue by adopting Recovery Action 32, which urges the FS and BLM to "Maintain substantially all of the older and more structurally complex multi-layered conifer forests on Federal lands outside of MOCAs…" based on the idea that "protecting these forests will not further exacerbate competitive interactions between spotted owls and barred owls as would occur if the amount of shared resources were decreased."[79] FWS failed to consider the full benefits of protecting all suitable habitat, including mature, not just old growth.

Logging mature forests will impair development of important features of old-growth forests, especially snags and dead wood.

Cutting mature forests and trees is generally not needed for ecological reasons. In fact, commercial logging will most often degrade rather than improve mature forest habitat. Foresters can make an argument that thinning helps grow big trees faster, but that's a tree-farmer's argument that is focused on growing a crop of big trees instead growing complex habitat.

Healthy late-successional forests are so much more than just big trees. Managers of public forests must strive to enhance other important aspects of healthy old forests, including large dead trees called snags, down wood, and multiple canopy layers. Of the six main attributes of old-growth forests, two involve dead trees (i.e., large accumulations of snags and dead wood). Looking at forest development once again as a continuum, restoration of complex old forests will require a reliable flow of material from the live-tree pool into the snag and down-wood pool, but logging interrupts that flow.

Restoring complex old forests requires that extra trees be retained to provide continuous recruitment of large snags and down wood. The latest Forest Inventory and Analysis report for Oregon states, "The presence of dead wood in a forest improves wildlife habitat, enhances soil fertility through nutrient cycling and moisture retention, adds to fuel loads, provides substrates for fungi and invertebrates, and serves as a defining element in old-growth forest. Because of this, the dead wood resource is often analyzed from a variety of perspectives— too much can be viewed as a fire hazard and too little can be viewed as a loss of habitat."[80]

The Scientific Panel on Ecosystem Based Forest Management explained:

> The fact that dead trees and logs are as important to ecosystem function as living trees challenges traditional forestry models that treat such materials as waste, fire hazards, and mechanical impediments. To move away from ecologically simplistic models, new forest management regimes must address questions such

[79] FWS 2008. Final Recovery Plan for the Spotted Owl, p 34.

[80] Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's forest resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf (citations omitted). It is important to note that large wood that is most valuable for wildlife and does not present a significant fire hazard and small hazardous fuels do not provide as much habitat value as large wood, so compatibility can be achieved if managers focus on removing small hazardous fuels while retaining medium and large trees.

> as: How much coarse woody debris is needed? and: How many snags in various stages of decay are required? to fulfill important ecological functions."[81]

Unfortunately, the agencies continue to rely on scientifically outdated methods that perpetuate the deficit of large snags and down wood,[82] and they continue to remove medium-sized trees that should be allowed to continue to grow and become ecologically valuable snags and dead wood. Heavy thinning of maturing forest has been shown to significantly delay attainment of snag objectives.[83] Which means that commercial thinning may be preventing or delaying development of essential features of old forest ecosystems, features that are important to spotted owls, salmon, and their prey.

The Eastside Scientific Societies Panel explained the keystone role of woodpeckers and the critical importance of snags and dead wood to the overall functioning of the forest. "The predatory impact of woodpeckers on pest insects is only part of the total predatory impact of the entire avian community. Many bird species continually feed on insect populations, and many depend on woodpeckers to construct the cavities they use. Therefore, maintenance of natural densities of woodpeckers may be crucial to the natural ecological response systems to insect irruptions."[84]

> A few scattered snags retained by forest management are not sufficient to provide nesting and roosting habitat into the future. Snags and logs in harvested areas and logs in streams remain only a finite time; the next generation of snags and large woody debris—in other words, live old trees—must be protected. Saving the remaining old-growth-

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[81] Franklin, J.F., D.A. Perry, R. Noss, D. Montgomery and C. Frissell. 2000. Simplified Forest Management to Achieve Watershed and Forest Health: A Critique. National Wildlife Federation, Seattle, Washington. http://www.coastrange.org/documents/forestreport.pdf (citations omitted).

[82] PNW Research Station, "Dead and Dying Trees: Essential for Life in the Forest," Science Findings, Nov. 1999 (http://www.fs.fed.us/pnw/sciencef/scifi20.pdf) ("Management implications: Current direction for providing wildlife habitat on public forest lands does not reflect findings from research since 1979; more snags and dead wood structures are required for foraging, denning, nesting, and roosting than previously thought."). Rose, C.L., Marcot, B.G., Mellen, T.K., Ohmann, J.L., Waddell, K.L., Lindely, D.L., and B. Schrieber. 2001. Decaying Wood in Pacific Northwest Forests: Concepts and Tools for Habitat Management, Chapter 24 in Wildlife-Habitat Relationships in Oregon and Washington (Johnson, D. H. and T. A. O'Neil. OSU Press. 2001) http://www.nwhi.org/inc/data/GISdata/docs/chapter24.pdf. Steve Zack, T. Luke George, and William F. Laudenslayer, Jr. 2002. Are There Snags in the System? Comparing Cavity Use among Nesting Birds in "Snag-rich" and "Snag-poor" Eastside Pine Forests. USDA Forest Service Gen. Tech. Rep. PSW-GTR-181. http://www.fs.fed.us/psw/publications/documents/gtr-181/017_Zack.pdf.

[83] USDA Forest Service. 2007. Curran Junetta Thin Environmental Assessment. Cottage Grove Ranger District, Umpqua National Forest. June 2007. Using data from stand exams modeled through FVS-FFE (West Cascades variant) the Umpqua NF found that the actual effect of heavy thinning is to capture mortality and delay recruitment of desired levels of large snag habitat for 60 years or more.

[84] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf

> dependent species, but preservation must be supplemented with plans for generating future old growth.
>
> Forest management that preserves selected snags does not adequately meet the foraging needs of LS/OG-associated species. Eliminating foraging habitat by extensive salvaging or selective cutting will have adverse consequences for pileated woodpeckers and other forest species dependent on cavities excavated by woodpeckers. Continual recruitment of standing dead and downed coarse woody material is absolutely necessary to support the diversity of organisms, including fungi and insects, that in turn provide a productive forest system for woodpeckers and other sensitive wildlife species.
>
> Elimination of deadwood habitat from the forest thus has adverse consequences on bird populations and seriously skews natural predator-prey relationships that may have a major influence on insect populations.[85]

In response to the significant loss of large and old trees on the eastside, ICBEMP proposed the following standards and objectives:

> Maintain and/or restore large shade-intolerant trees and snags in densities that are consistent with the range of historical conditions. … *Large trees* is a relative term dependent on species and site. Large trees are a future source of large snags, and large snags are a future source of coarse woody debris, another important habitat component for many species. It is important to have present and **future sources of large trees** and snags at adequate levels though time. Larger snags are generally better than smaller snags because they exist longer. Large trees and/or snags are essential habitat components for many species …
> …
> Maintain and/or recruit adequate numbers, species, and sizes of snags and levels of downed wood to meet the needs of wildlife, invertebrates, fungi, bryophytes, saprophytes, lichens, other organisms, long-term soil productivity, nutrient cycling, carbon cycles, and other ecosystem processes.[86]

Meeting these goals will require retention of plenty of recruitment trees in the mature age class. Unfortunately, ICBEMP science has not yet been implemented or incorporated into existing forest plans.

After Congressman Charles Taylor commissioned Oliver et al. (1997)[87] to prepare a report urging more logging to make our National Forests healthier, the Ecological Society of America responded with a report confidently concluding that "there is no scientific basis for asserting that

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[85] Henjum (1994) (citations omitted).

[86] USDA/USDI 2000. ICBEMP SDEIS p 3-66 – 3-68.

[87] Oliver, C., D. Adams, T. Bonnicksen, J. Bowyer, F. Cubbage, N. Sampson, S. Schlarbaum, R. Whaley, and H. Wiant. 1997. Report on forest health of the United States by the Forest Health Science Panel. A panel chartered by Charles Taylor, Member, U.S. Congress. Washington, D.C.

silvicultural practices can create forests that are ecologically equivalent to natural old-growth forests, although we can certainly use our understanding of forest ecology to help restore managed forests to more natural conditions."[88] The NRC Report (2000) concurred, explaining that "proponents of active timber harvest on all or most of the landscape argue their approach reflects current ecological thinking, which recognizes nature is inherently dynamic. … This view recently was critiqued by a panel of the Ecological Society of America (ESA) which disagreed strongly with the conclusions of Oliver and colleagues (Aber 2000). This committee concurs with the ESA panel ..."[89] The authors point out that reserves are not static, rather reserves should be extensive enough to subsume the natural disturbance processes that create and maintain complex forests, and "there is little evidence that managed stands are healthier than unmanaged stands. In fact, quite the contrary …"

[88] Aber, J., N. Christensen, I. Fernandez, J. Franklin, L. Hidinger, M. Hunter, J. MacMahon, D. Mladenoff, J. Pastor, D. Perry, R. Slangen, H. van Miegroet. 2000. Applying ecological principles to management of the U.S. National Forests. Issues in Ecology, No.6, 20pp. http://esa.org/science_resources/issues/FileEnglish/issue6.pdf

[89] NRC 2000. pp 189-190. The heavy-handed silvicultural approach was also roundly criticized by The Scientific Panel on Ecosystem Based Forest Management: Jerry Franklin, David Perry, Reed Noss, David Montgomery, and Christopher Frissell. See Franklin et al. (2000).

Snags like this are an essential element of old growth forests.
A forest without dead trees like this is not a healthy forest.

Logging in mature forests like this just removes trees that are needed for future recruitment of snags that enrich old growth habitat over time.

In all forest types, recognize that logging has trade-offs.

There's no free lunch. All logging—including thinning stands of any age—involves adverse impacts and trade-offs. Some impacts of logging are unavoidable, so there is no such thing as a logging operation that is 100% beneficial to ecological restoration. Depending on how it is done thinning can have adverse impacts such as:

- soil compaction and disturbance;
- habitat disturbance and wildlife displacement;
- carbon emissions to the atmosphere;
- introducing and spreading weeds;
- removal and reduced recruitment of snags and large wood;
- road-related erosion and hydrologic modification, and opening access for fire ignition and OHV trespass;
- moving flammable small fuels from the canopy to the ground; and
- creating a hotter-dryer-windier microclimate that is favorable to greater flame lengths and rate of fire spread.

Some of these negative effects are fundamentally unavoidable. Therefore, all thinning has negative effects that may be partially compensated by beneficial effects such as:

- reducing competition between trees so that some can grow larger faster;
- increased resistance to drought stress and insects;
- increasing species diversity; and
- possible (but by no means certain) fire hazard reduction.

It is generally accepted that when thinning occurs in very young stands, net benefits are more likely to arise because the benefits outweigh the adverse impacts. Conversely, when thinning occurs in older stands, net benefits are unlikely because negative impacts on soil, water, weeds, carbon, and dead wood recruitment will tend to outweigh the benefits, resulting in a negative ecological balance sheet. The ICBEMP Team said that "there are instances where long-term benefits may not exceed short-term environmental costs or adverse ecosystem impacts, making passive restoration approach more appropriate."[90] As we move along the continuum from thinning young forests to logging older forests, net benefits very often turn into net negative impacts, but where is that line? Within the range of the owl, the Northwest Forest Plan found 80 years to be a good place to draw the line. In dry forests being managed to reduce fire hazard, the Scientific Panel on Ecosystem Based Forest Management concluded that thinning mature stands would likely lead to problems that exceed any benefits, so thinning programs should be limited to younger stands. "Thinning only small and intermediate trees less than 100 years old could decrease fire risk, depending on how much new risk is introduced by logging slash (or its

[90] Thomas Quigley, ed., Integrated Scientific Assessment for the Interior Columbia Basin. PNW-GTR-382, Sept 1996. p 177.

disposal). … The challenge is to alleviate one problem without exacerbating others or creating new ones (Perry 1995). Therefore, each project requires careful thought and analysis."[91]

In moist provinces, mature forests just need time, not logging.

Mature forests are already starting to exhibit complex forest characteristics and they will continue to develop and improve without human intervention. As recognized in the Northwest Forest Plan standards and guidelines for Late Successional Reserves, stands over 80 years old in the moist westside provinces are most likely to become old growth in the absence of silvicultural manipulation.[92] The transition from mature forest to old growth is a process that takes time and varies depending on factors such as location, species, and disturbance events. In a mature forest, all the ingredients are there to make old growth (e.g., large and growing trees, material for recruitment of snags and logs, mortality processes that create canopy gaps, etc.). These forests don't need logging; they need time to develop.

In moist areas, young forests are most likely to benefit from thinning. The most appropriate use of logging technology is to thin dense young stands that developed following clearcutting. The Northwest Forest Plan prohibits logging of stands 80 years or older in the Late Successional Reserves for several reasons: (a) such stands are beginning to acquire late successional characteristics and provide valuable habitat for spotted owls and other wildlife; (b) there is a lack of evidence to support the hypothesis that logging in stands >80 years old is beneficial to habitat development; and (c) logging will likely do more harm than good.

This reasoning is articulated in several scientific reports, including the 1990 Interagency Scientific Committee (ISC) Report, the 1993 SAT Report, and various reports to Congress where the scientists were being asked to explain to a skeptical committee in Congress why logging old forests could not be compatible with conserving late-successional forest ecosystems. The ISC report said "no consensus exists about whether any silvicultural systems would produce the desired results. The ability to harvest timber in currently suitable owl habitat and have that habitat remain suitable has not been clearly demonstrated."[93]

The SAT noted that "considerable additional research is likely required" before we will know whether silviculture can be compatible with spotted owls, and while the spotted owl is relatively well studied, the risks and uncertainty are even more pronounced for the hundreds of other

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[91] Franklin, J.F., D.A. Perry, R. Noss, D. Montgomery and C. Frissell. 2000. Simplified Forest Management to Achieve Watershed and Forest Health: A Critique. National Wildlife Federation, Seattle, Washington. http://www.coastrange.org/documents/forestreport.pdf

[92] USDA/USDI 1994. Northwest Forest Plan ROD, Attachment A, pages B-6, C-11, C-12. April 1994. *and* Pers. Comm. David Perry (Professor [emeritus], Oregon State University School of Forestry) to David Dreher (Legislative Assistant to U.S. Rep. Peter DeFazio), 15 June 2002.

[93] Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A Conservation Strategy for the Northern Spotted Owl. A report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. USDA, Forest Service, and U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Portland, OR (*herein* ISC Report), 1990, p 104.

species associated with old-growth.[94] It should also be recognized that President Clinton's Mission Statement directed the FEMAT team to ensure that "tests of silviculture should be judged in an ecosystem context and not solely on the basis of single species or several species response."[95]

The 1993 Report of the Scientific Analysis Team (SAT) specifically highlighted the risks associated with logging in suitable owl habitat, saying "intentions to selectively cut forest stands to create conditions favorable for spotted owls, represents increased risks to the viability of the spotted owl."[96] The Scientific Analysis Team said there are several factors that support this conclusion and affirm the Interagency Scientific Committee's decision to exclude logging in old growth reserves and rely on natural processes to maintain and restore habitat:

a. "Lacking experience with selective cutting designed to create spotted owl habitat, such practices must be considered as untested hypotheses requiring testing to determine their likelihood of success. ... Given the uncertainty of achieving such expectations, it is likely that some silvicultural treatments, which have been characterized as largely experimental, may well have an opposite effect from that expected. Consequently, such treatments may hinder the development of suitable habitat or they may only partially succeed, resulting in development of marginal habitat that may not fully provide for the needs of spotted owls. Results which fall short of the expected conditions could occur because of delay or failure to regenerate stands that have been cut, increased levels of windthrow of remaining trees, mechanical damage during logging to trees remaining in the logging unit, the spread of root rot and other diseases. Increased risk of wildfires associated with logging operations that increase fuels and usually employ broadcast burning to reduce the fuels also increase the risk of not attaining expected results. Such events may spread to areas adjacent to stands that are logged, thereby affecting even more acreage than those acres directly treated." [SAT p 147-148] The SAT indicates that these comments apply equally to density management and patch cutting, both of which are being promoted as tools to enhance owl habitat. The SAT also cited concerns about the effect of logging on snags and down woody debris which are essential features of owl habitat.

b. "Planning produces a description of desired future conditions [and] culminates in a final plan for a project which, for timber sales, involves legal contracts obligating the purchaser and the seller to specific provisions. … Our experience is that commonly not all provisions of the plan are thoroughly incorporated into such contracts, nor are all contract provisions thoroughly administered to ensure compliance." [SAT p 148-149].

c. "There are also probabilities associated with how well monitoring will identify 'trigger points' that indicate a management plan may need modification. The more complex the plan (i.e., the more variables there are to monitor) the less likely the monitoring plan will

[94] Thomas, JW, Raphael, MG, Anthony, RG, Forsman ED, Gunderson, AG, Holthausen, RS, Marcot, BG, Reeves, GH, Sedell, JR, and DM Solis. 1993. Viability Assessments and Management Considerations for Species Associated with Late-Successional Old-Growth Forests of the Pacific Northwest. The Report of the Scientific Analysis Team (*herein* SAT Report), 1993, p 147.

[95] FEMAT Report, p iii.

[96] SAT Report p 145.

successfully detect problems. Manipulation of forest stands to accelerate development of spotted owl habitat on a landscape scale, as prescribed in the Bureau of Land Management Preferred Alternative, is an extremely complex issue involving a myriad of variables over a very long timeframe. Development of a monitoring plan intensive enough to isolate the causes of observed variations for wide-scale implementation of the Bureau of Land Management Preferred Alternative seems unlikely to us. … [I]nadequate monitoring will increase, perhaps dramatically, the risk of failure of a plan that relies heavily on adaptive management." [SAT p 149].

d. "A basic requirement for a viable adaptive management strategy is the existence of resources necessary to make the required adjustments. Adaptive management can only be expected to reduce risk if options to adjust management to fit new circumstances are not eliminated. Adaptive management, therefore, can be considered a means to reduce risk associated with a Resource Management Plan commensurate with the options for adjustment which remain during the time the plan is in effect." [SAT p 149-150] In other words, silvicultural manipulation of mature forests has long-term consequences and is likely to foreclose some future options in those stands, thus reducing the utility of adaptive management. A prime example is the fact that logging "captures mortality," yet mortality is an essential feature of old-growth habitat used by both spotted owls and their prey.

e. SAT then noted the cumulative effects of all these uncertainties: "The combined risks associated with treatment of spotted owl habitat or stands expected to develop into suitable habitat for spotted owls, as discussed above, will likely result in situations where either habitat development is inhibited or only marginal habitat for spotted owls is developed. The exact frequency of these partial successes or failures is unknown. Given the likely cumulative relationship among the risks for each factor, it appears to us that the overall risk of not meeting habitat objectives is high. … Members of the Interagency Scientific Committee indicated that, because a plan (the Interagency Scientific Committee's Strategy) was put forth which proposes to reduce the population of a threatened species by as much as 50 percent, providing the survivors with only marginal habitat would be extremely risky and certainly in their minds not 'scientifically credible' (USDA 1991:45)." [SAT p 151].

f. The SAT concluded, "The transition period (1-50 years) between implementation of the Interagency Scientific Committee's Strategy and achievement of an equilibrium of habitat and spotted owls is a critical consideration. … Given the existing risks that face owl populations and the sensitivity of the transition period, the short-term effect of these actions on habitat loss may be much more significant than the long-term predicted habitat gains. We further conclude that, although research and monitoring studies are presently being initiated, no significant new data exist which suggest that the degree of certainty that is expressed in the Bureau of Land Management Draft Resource Management Plans for developing owl habitat silvicultural treatments is justified. Therefore, it is our opinion that the course prescribed in the Interagency Scientific Committee's Strategy, pertaining to timber harvest in Habitat Conservation Areas, remains the most likely course to result in superior habitat conditions within reserves (i.e., Old-Growth Emphasis Areas). The approach prescribed by the Interagency

> Scientific Committee's Strategy preserves options for adjustments in the course of management under a philosophy of adaptive management." [SAT p 151-152].

The authors of the Northwest Forest Plan took all this into account and determined that 80 years is a useful place to draw the line between younger forests that are likely to benefit from careful thinning and older forests that are likely to experience net negative consequences.[97] There is no new science to change that conclusion. In fact, new information developed since 1994 shows that dead wood is probably more valuable than previously thought. It is important for a wide variety of ecological functions, not least of which is providing complex habitat to support owl prey species. Thinning stands over 80 years will remove many large trees and prevent them from ever becoming snags and dead wood. The long-term loss of recruitment of dead wood habitat in older stands is a very strong argument against logging in stands over 80 years old.[98]

Structure-based management (SBM) is often suggested as a way to produce logs and habitat from the same forests, but this is not a well-supported approach to managing older forests. There are well-founded critiques which point out that structure-based management is untested, uncertain, high risk, and unlikely to result in desired outcomes. Consider the well-developed critique of structure based management set forth by the Scientific Panel on Ecosystem Based Forest Management:

> The concept that all forests must be silviculturally manipulated (logged) and eventually replaced in order to provide desired goods and services, including the continued health of forest landscapes, is an old and honored tradition. … The proposition that forest values are protected with more, rather than less logging, and that forest reserves are not only unnecessary, but undesirable, has great appeal to many with a vested interest in maximizing timber harvest. … Our interpretation of the scientific literature, combined with our professional experience, leads us to some very different conclusions about appropriate approaches. Scientifically based strategies for the conservation of forest ecosystems, with a sound theoretical basis in conservation biology—including biodiversity and critical ecological services—have inevitably incorporated reserves along with ecologically sensitive management of unreserved areas (e.g., FEMAT 1993). … In our view, the assumptions underpinning simplified structure-based management (SSBM) are not supported by the published scientific literature on structural development of natural forests, disturbance ecology, landscape ecology and conservation biology, or by the relationships between ecosystem structures

[97] See 1993 SAT Report pp 146-152. AND February 1991 Questions and Answers on A Conservation Strategy for the Northern Spotted Owl (prepared in response to written questions from the Senate Energy and Natural Resources Committee to the Interagency Scientific Committee on the May 1990 ISC Report. AND Jerry Franklin, David Perry, Reed Noss, David Montgomery, Christopher Frissell. Simplified Forest Management To Achieve Watershed And Forest Health: A Critique. National Wildlife Federation. http://www.coastrange.org/documents/forestreport.pdf

[98] USDA Forest Service. 2007. Curran Junetta Thin Environmental Assessment. Cottage Grove Ranger District, Umpqua National Forest. June 2007. http://www.fs.fed.us/r6/umpqua/projects/projectdocs/curran-junetta-thin/index.shtml This EA revealed that heavy thinning in young stands would delay attainment of objectives for recruitment of dead wood for 6 decades or more.

> and processes. … We do not believe, however, that scientific literature or forestry experience supports the notions that intensively managed forests can duplicate the role of natural forests, or that sufficient knowledge and ability exist to create even an approximation of a natural old-growth forest stand.[99]

Allowing logging in stands up to 80 years old may be too generous. Trees that still have a lot of growing to do are far more likely to respond well to thinning because they can put more growth into their still-developing crowns. Older trees that are not expected to grow much taller have much less responsive crowns and will not respond as well to thinning.[100] Some studies indicate that stands over 50 years old may be less amenable to thinning. Recent research indicates that a substantial portion of a tree's size and character at several hundred years of age can be explained by the tree's rate of growth at age 50, and recent modeling "found it difficult to alter the development trajectories of well-established young stands that were first managed at age class 50," and concluded that earlier intervention would have promoted deeper crowns and greater diameter class differentiation.[101] This leads to a tentative conclusion that thinning stands younger than 50 years old should be a higher priority than thinning stands older than 50 years.

In dry provinces, fire hazard is over-stated. Logging mature trees will just make things worse.

The ICBEMP investigations show that fire hazard in northwest forests is not as bad as some are claiming.

> About 6 percent of the FS/BLM administered lands in the ICBEMP management region experience at least moderate levels of uncharacteristic wildfire probability. These are broadly scattered across the landscape. Much of this occurs in dry forest where the interaction of fire suppression, insects and disease, and succession has produced uncharacteristically high fuel levels. … The great majority (80 percent or more) of lands administered by the FS/BLM in the ICBEMP management region currently experience low probabilities of uncharacteristic wildfire. … Fire disturbances are about equally split between low, moderate and high classes at present.[102]

The US Forest Service program on Forest Inventory and Analysis (FIA) recently analyzed forest fire hazard across the state of Oregon and found similar results.

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[99] Jerry Franklin, David Perry, Reed Noss, David Montgomery, Christopher Frissell. Simplified Forest Management To Achieve Watershed And Forest Health: A Critique. National Wildlife Federation. http://www.coastrange.org/documents/forestreport.pdf

[100] Tappeiner, J.C., II, Emmingham, W.H., and D.E. Hibbs 2002. Silviculture of Oregon Coast Range Forests. Chapter 7 in Forest and Stream Management in the Oregon Coast Range. Edited by Stephen D. Hobbs, John P. Hayes, Rebecca L. Johnson, Gordon H. Reeves, Thomas A. Spies, John C. Tappeiner II, and Gail E. Wells, 2002.

[101] Andrews, Perkins, Thrailkill, Poage, Tappeiner. 2005. Silvicultural Approaches to Develop Northern Spotted Owl Nesting Sites, Central Coast Ranges, Oregon. West. J. Appl. For. 20(1):13-27. (emphasis added).

[102] Miles A. Hemstrom, Wendel J. Hann, Rebecca A. Gravenmier, Jerome J. Korol. 2000. [SAG] Landscape Effects Analysis of the [ICBEMP] SDEIS Alternatives. USDA/USDI, *draft* March 2000.

> These [forest inventory and analysis] data paint a different picture of fire hazard and fuel treatment opportunity than do certain commonly used maps of fire regime condition class (Hardy et al. 1999; Schmidt et al. 2002). … Under the fire weather assumed for this analysis, less than half the forested lands are predicted to develop crown fires, and an even smaller fraction, 5 to 15 percent, can be expected to develop active crown fire. … From the standpoint of implementing fuel treatments, these results suggest that only a fraction of the forested landscape is likely to benefit from fuel treatment if the objective is to reduce crown fire hazard. Given that spatial analyses of fuel treatments has demonstrated that treating a small percentage of the landscape can reduce landscape-scale fire hazard significantly and sometimes cost-effectively (Finney 2001), these results suggest that the fuels management challenge may be more tractable than has been assumed.[103]

Hanson et al (*in press*) reviewed 2 decades of fire records in conifer forests in dry provinces of the Northwest Forest Plan and found that the proportion of area burned and the severity of fire has not changed significantly.[104] These findings, along with the evidence that logging has unavoidable adverse impacts, indicates that caution is warranted. We should not encourage excessive and unwarranted logging in mature forests. PNW Research Station recently reported that profit-driven fuel reduction logging can conflict with both habitat objectives and fire risk reduction objectives.[105]

If there is a new push for timber volume from mature forests and trees, it will cause fire hazard to increase. Commercial logging can increase fire hazard by making forest stands hotter and windier, and fuels dryer. "Thinning opens stands to greater solar radiation and wind movement, resulting in warmer temperatures and drier fuels throughout the fire season. [T]his openness can encourage a surface fire to spread. …"[106] Opening the canopy also stimulates the growth of new surface and ladder fuels, and logging moves fine fuels from the canopy to the ground where they are more available for combustion.

BLM's Western Oregon Plan Revision EIS confirms that fire hazard will increase in areas managed for timber production, and that retaining more canopy cover would help reduce fire hazard. "The more canopy that would remain, the less effect wind would have on drying fuels and surface fires. This reduction in mid-flame wind speed would reduce flame length, which can

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[103] Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's forest resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf (emphasis added).

[104] Hanson, C.T., Odion, D.C., DellaSala, D.A., and W.L. Baker. *in press.* Overestimation of fire risk in Northern Spotted Owl Recovery Plan. Conservation Biology.

[105] PNW Research Station. 2006. Seeing The Bigger Picture: Landscape Silviculture May Offer Compatible Solutions To Conflicting Objectives. Science Findings. July 2006. http://www.fs.fed.us/pnw/sciencef/scifi85.pdf

[106] USDA Forest Service; Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects, November 2003. http://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf

lead to a reduction in tree mortality. … A lower probability of mortality equates to greater fire resiliency."[107]

Current project planning methods do not fully integrate all the complex ways that logging can influence both fuel structure and microclimate over time. Effective fuel reduction must strive for the "sweet spot" by removing just enough of the small surface and ladder fuels, while retaining enough of the medium and large trees to maintain canopy cover and microclimate, suppression of in-growth, hydrology, as well as current and future habitat, etc. This balance requires retention of all mature trees and many medium-sized trees.

Consider these words from Mike Dombeck, former Chief of the Forest Service:

> Some argue that more commercial timber harvest is needed to remove small-diameter trees and brush that are fueling our worst wildlands fires in the interior West. However, small-diameter trees and brush typically have little or no commercial value. To offset losses from their removal, a commercial operator would have to remove large, merchantable trees in the overstory. Overstory removal lets more light reach the forest floor, promoting vigorous forest regeneration … precisely the small diameter materials that are causing our worst fire problems. In fact, many large fires in 2000 burned in previously logged areas laced with roads. It seems unlikely that commercial timber harvest can solve our forest health problems.[108]

The Eastside Scientific Societies were also skeptical about the value of commercial logging in stands other than plantations. "Managing eastside forests within NRV [natural range of variability] dictates that the area of ponderosa pine old growth be increased from 4 to 20 times in areas where it once dominated. … To attain this goal, existing second-growth pine and isolated individuals must provide the cornerstones around which to rebuild the landscape. Any logging of remaining pine, except for thinning in overstocked stands, moves the landscape further from NRV. (Even thinning may better be left to natural processes if it threatens resident biotic components.)"[109]

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[107] BLM. 2008. Western Oregon Plan Revision FEIS, pp 810-811.

[108] Dombeck, M. 2001. How Can We Reduce the Fire Danger in the Interior West. Fire Management Today, Winter 2001. Vol 61(1). http://www.fs.fed.us/fire/fmt/fmt_pdfs/fmn61-1.pdf

[109] Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the Cascade crest, Oregon and Washington. The Wildlife Society Technical Review 94-2. Bethesda, MD. 245 pp. (aka the report of the Eastside Scientific Societies Panel) http://andykerr.net/downloads/EastsideScien.pdf

Logging like this on the Fremont National Forest can sometimes just add to the fuel problems.

Logging is but one tool. Timber sales won't solve all our problems.

There is a mismatch between the restoration requirement and the agencies' preferred management tool – the timber sale. Our degraded forests and watersheds certainly need restoration, but how will it be accomplished? Two of the most important restoration activities include rescaling the road system and reducing the density of small trees, but both of these activities cost money. If we try to subsidize these activities by removing too many commercial trees, we can no longer legitimately call it restoration; it would just be commodity production, with associated adverse impacts, under a new name.

Most conservation groups are not opposed to the use of logging as a management tool in appropriate circumstances. There are instances where there may be commercial-sized trees in excess of ecological needs, and restoration logging might generate some revenue, but these circumstances are far rarer than most people recognize. If we focus our efforts on this small subset of the problem, we will be neglecting the vast majority of the restoration need.

We cannot base public policy on another false hope that restoration will be facilitated by plenty of big trees and commercial logging opportunities, especially in areas with relatively low productivity. A recent report from Oregon's Blue Mountains confirms what conservationists

have known for years, that past management has taken too many of the big trees and left current managers with limited options.

> Hoping to boost their economies and also restore these forests, local leaders are interested in the economic value of timber that might be available from thinning treatments on these lands. … [W]e found that on lands where active forestry is allowable, thinning of most densely stocked stands would not be economically viable. … Commercial thinning would only be possible where the value of the timber harvested exceeds the cost of the harvesting, hauling, road maintenance, and contractual requirements (i.e., a positive net revenue exists). Because most simulated thinnings harvested low volumes of small trees, commercial removal was possible on … less than 10 percent of the densely stocked acres … [E]ven when considered under the most favorable of assumptions, most densely stocked stands would not be treatable without significant investments.[110]

Commercial logging is not a very useful tool for restoration because it can only address a small fraction of the restoration needs in degraded forests. In the past the most productive sites were disproportionately affected by clearcutting and high-grading, and now there are few large trees left. Most over-stocked stands will not support a viable timber sale that sustains the other important values in the forest such as fish & wildlife, water quality, and carbon storage.

Restoration forestry requires retention of far more legacies and recruitment trees than traditional forestry and this has a consequences in terms of timber sale viability. The abundance and distribution of snags and large dead wood is one of the key differences between harvested and unharvested stands.[111] Jerry Franklin urges us to:

> incorporate current knowledge of … the role of disturbances in creating structural legacies that become key elements of the post disturbance stands. … [P]rinciples from disturbance ecology and natural stand development [can be used] to create silvicultural approaches that are more aligned with natural processes. Such approaches provide for a greater abundance of standing dead and down wood and large old trees, perhaps reducing short term commercial productivity but ultimately enhancing wildlife habitat, biodiversity, and ecosystem function, including soil protection and nutrient retention.[112]

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[110] Rainville, Robert; White, Rachel; Barbour, Jamie, tech. eds. 2008. Assessment of timber availability from forest restoration within the Blue Mountains of Oregon. Gen. Tech. Rep. PNW-GTR-752. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 65 p. http://www.fs.fed.us/pnw/pubs/pnw_gtr752.pdf

[111] Aber 2000.

[112] NCSSF/PNW Old Growth Workshop. Bonneville Hot Springs Resort. May 2005. http://www.fsl.orst.edu/Oldgrowthworkshop/statements/Franklin.pdf

But this is a far cry from traditional commercial forestry. "Restoration of an old-forest network carries with it long-term management costs with little commodity production."[113]

Another problem with timber sales as a restoration tool is that they require roads. Mature forests often lack road access because they have not been actively managed for a long time, if ever. When these forests are targeted for logging, construction of harmful logging roads is often required.[114] ICBEMP found that:

> From an intensive review of the literature, we conclude that increases in sedimentation are unavoidable even using the most cautious roading methods. … [T]wo analyses examining the correlation of roads to habitat and fish population status … support the general conclusion that increasing road density correlates with declining aquatic habitat conditions and aquatic integrity. … The ability of the Forest Service and Bureau of Land Management to conduct road maintenance has been sharply reduced because of declining budgets. This is resulting in progressive degradation of road drainage structures and a potential increase in erosion. …[115]

The BLM's Western Oregon Plan Revision anticipated the need to construct 1300 miles of new roads in an already heavily roaded landscape mainly to facilitate the removal of non-deferred forests 80-159 years old. Since the agencies lack the funds to maintain the existing over-built road system, it is unwise to add to the problem by building more roads.

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[113] Everett, R., P. Hessburg, J. Lehmkuhl, M. Jensen, and P. Bourgeron. 1994. Old Forests in Dynamic Landscapes: Dry-Site Forests of Eastern Oregon and Washington. Journal of Forestry 92: 22-25.

[114] USDA Forest Service, "Forest Roads: A Synthesis of Scientific Information," Pacific Northwest Research Station, General Technical Report PNW-GTR-509. May, 2001. Noss, Reed; The Ecological Effects of Roads. http://www.wildlandscpr.org/ecological-effects-roads. NRDC Report: "End of the Road: The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research" (1999) http://www.nrdc.org/land/forests/roads/eotrinx.asp

[115] Quigley, Thomas M.; Arbelbide, Sylvia J., tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume 1. Gen. Tech. Rep. PNW-GTR-405. Portland, OR. http://www.fs.fed.us/pnw/publications/pnw_gtr405/pnw_gtr405_07.pdf

The need for restoration must be weighed against the adverse effects of road building on soil, water, wildlife, and weeds.

Temporary roads are a misnomer. Their use may be temporary, but adverse effects of road building are often long-lasting.

The architects of the Northwest Forest Plan found that many of the best, large, contiguous forest landscapes are mature, not old-growth, forests.

Some large forest fires burned west of the Cascades between 1840 and 1910, and many such areas were skipped over during "harvest scheduling" because there was a higher priority on converting the very old forests to tree plantations. These former fire areas, now mature forests, offer some of our best hopes of recreating large blocks of unfragmented, contiguous old-growth forest, which is an important goal of the Northwest Forest Plan, and critical to the recovery of old-growth associated wildlife.

Leaving mature forests unprotected would leave substantial areas of roadless forests subject to future conflict. Many westside roadless areas may not qualify as old growth, but still provide important values as roadless and mature forests.[116] Examples of roadless areas with significant stands of mature forest include Moose Creek, Mount Hagen, and Hardesty Mountain on the Willamette National Forest, Mt Hebo on the Siuslaw National Forest, Roaring River and Olallie Lakes on the Mt. Hood National Forest, Twin Lakes on the Umpqua National Forest, and Zane Grey on the Medford BLM. In northern California, the Kangaroo, Greider Creek, and Orleans Mt. roadless areas on the Klamath National Forest and the Salt Creek and Soldier Creek roadless areas on the Six Rivers National Forest all contain significant areas of mature forest. In Washington, examples include Dark Divide, Horseshoe, Pompey, and Wobbly roadless areas on the Gifford Pinchot National Forest.

Federal lands must carry more than their share of late-successional forest to compensate for non-federal forest practices.

Even though non-federal forests have a disproportionate share of the best tree-growing lands (Site Class 1 and 2), old forests are extremely rare on non-federal lands. The remaining mature and old-growth forest that does exist occurs predominantly on federal forests lands, so these lands represent the best place to look for timely restoration of old forests.[117] Because young forests are over-represented and unlikely to develop into old-growth on private lands, public lands should emphasize restoring some "extra" older forests to compensate.

Harvest rotation ages on non-federal forest lands are trending downward, which further simplifies the landscape and deprives wildlife of the habitat features they need to survive. Nonaka & Spies (2005) found that it will be challenging to support a functional old growth ecosystem on federal lands alone.

> Under the [current policy scenario], ownership pattern indirectly constrained development of landscape structure because of the contrasting forest management regimes used by different ownership types. … For example, young forests will

[116] Strittholt, J. 2005. Oregon Legacy Wild Forests. CBI. http://www.consbio.org/what-we-do/oregons-legacy-wild-forests

[117] Donnegan, Joseph; Campbell, Sally; Azuma, Dave, tech. eds. 2008. Oregon's forest resources, 2001–2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-765. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station. 186 p. http://www.fs.fed.us/pnw/publications/gtr765/pnw-gtr765b.pdf p 36.

> occur primarily on private lands, and mature and old-growth forests will occur primarily on state and federal lands. … [N]ot all landowners have the same ecological goals. Consequently, even if public lands had a goal of achieving the [historic range of variability] of landscape structure, it would not be possible to reach it using those lands alone.[118]

Until industrial forest practices are reformed, federal forests must be managed to compensate for a severe lack of old-growth, lack of large snags and down wood, and severely degraded habitat quality on non-federal lands.

If non-federal forests continue to be managed like this, then federal forests need extra protection in order to compensate.

Mature forests on Oregon BLM lands deserve extra protection.

Certain areas deserve extra protection because they have been disproportionately impacted by past clearcutting and are fragmented by ownership patterns. In other words, mature forests become even more valuable and important in areas where old growth is acutely depleted, such as BLM's holdings in western Oregon and the Oregon Coast Range. "[I]t is critical that ecosystem

[118] Nonaka, E., Thomas A. Spies. 2005. Historical Range Of Variability In Landscape Structure: A Simulation Study In Oregon, USA. Ecological Applications, 15(5), 2005, pp. 1727–1746.

types that have received greater proportional cutting, especially the low-elevation forests on the Westside, be provided the highest level of protection and restoration."[119] This aptly describes BLM lands in western Oregon.

Unfortunately, the BLM's recently adopted Western Oregon Plan Revision would dramatically increase the rate of liquidation of mature forests, because the oldest forests are temporarily protected in "deferred timber management areas." With old growth forests still included in the timber base but temporarily off-limits, BLM can only meet it's unrealistic high timber targets by increasing the rate of mature forest clearcutting. This will just decimate the next generation of old growth in spite of the critical ecological value of BLM lands in western Oregon.

The Scientific Analysis Team found that "reduced long-term distribution of spotted owl habitat linking the Oregon Coast Range, Klamath Mountains, and Oregon Cascades West Physiographic Provinces is highly likely to reduce chances of spotted owls moving among these provinces. The distribution of [reserves in] National Forests alone will not meet the Interagency Scientific Committee's Strategy's requirements for well-distributed blocks of habitat connected by dispersal habitat."[120]

Social Reasons to Protect Mature Trees and Forests

The public strongly supports protection of mature forests.

Sixty-five percent of residents of Oregon and Washington support protection of not just old growth, but also mature forests, on National Forest and BLM lands.[121] This support spans virtually all demographics, with greater than 60% support among men and women, all age groups, all education levels, rural and urban counties, those who have lived in the Northwest for a short time or a long time, and every income bracket.

The only group that did NOT have a majority in support of mature forest protection was self-identified Republicans, with only 48% in support. However, there were still more Republicans in support of protection than opposed to protection (48% vs. 46%). Notably, 78% of Democrats support protection of mature forests, as do 69% of self-identified "independent" or "other" voters.

Logging mature forest is socially unacceptable and will remain controversial and legally entangled.

We cannot resolve the ongoing conflict over management of older forests by protecting just the old growth while leaving mature forests legally unprotected. OSU's K. Norm Johnson made a prescient observation in 1993 when he told Congress, "While option 9 may reserve the lion's share of late successional forest on federal land, it does not escape the historic dependence on

[119] NRC 2000. p 6.

[120] 1993 SAT Report. Chapter 2, p 69. citations omitted.

[121] Davis, Hibbitts & McCaig, Inc. 2002. Mature Growth Forests. February 2002.

late-successional forest and old growth as the source of harvest volume. How publicly acceptable this policy will be remains to be seen."[122] Recent history has shown that the public will not tolerate more destructive logging of mature and old-growth forests, nor will they tolerate a delay in the natural rate of recovery of old forests and their value for drinking water, carbon storage, fish and wildlife, and recreation. The public's aversion to non-restorative logging on federal forest lands has only been increased by the infamous 1995 Rescissions Act "salvage rider," the agencies' failure to faithfully implement the Aquatic Conservation Strategy and Survey and Manage programs, and the Bush Administration's assault on listed species and the NWFP.[123]

Recently reported results from the DEMO project (Demonstrating Ecosystem Management Options) show that the public acceptability of logging is more strongly influenced by the effect of logging on wildlife habitat than the impact of logging on scenic quality.[124] This highlights the importance of maintaining habitat to support viable populations of native wildlife as required by the 1982 regulations implementing the National Forest Management Act.

Adopting a partial solution by protecting just old growth and encouraging inappropriate commodity extraction from mature forests would lead to more conflict. Shifting federal forest management to a restoration paradigm gets everyone at the table working toward a common goal. Fortunately, there is emerging common ground never before seen in the northwest. In recent years, practical, non-controversial, science-based restoration efforts receive broad support among the public and the scientific community. These restoration priorities include: thinning dense young planted stands; removing small fuels from forests that suffer from fire exclusion; rescaling the road system; reintroducing fire; and, rehabilitating streams. Implementing these priority actions can improve ecosystems, create jobs, and produce a modest supply of timber.

If forest policy protects only old-growth forests and tries to encourage logging of mature forests,[125] controversy will continue and very little timber from mature forest will make it to the mill. It is unlikely that Congress will adopt radical amendments to the Endangered Species Act and other popular laws as such changes would be politically unpopular.

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[122] Johnson, K.N. 1993. Testimony concerning the Administration's forest ecosystem management plan for the Pacific Northwest: Joint hearing before the Subcommittee on Specialty Crops and Natural Resources of the Committee on Agriculture, and the Subcommittee on National Parks, Forests, and Public Lands of the Committee on Natural Resources, and the Subcommittee on Environment and Natural Resources of the Committee on Merchant Marine and Fisheries, House of Representatives, One Hundred Third Congress, First Session, August 3, 1993 http://www.archive.org/stream/administrationsf00unit/administrationsf00unit_djvu.txt

[123] Heiken, D. 2004. "The Northwest Forest Plan Ten Years Later" Outlook [newsletter]. Oregon State Bar Environment and Natural Resources Section. Summer 2004. http://dl-client.getdropbox.com/u/47741/Northwest%20Forest%20Plan%20ten%20years%20later%20%28DH%20final%29.doc

[124] Aubry, K.B., Halpern, C.B., and C.E. Peterson. 2009 *in press*. Variable-retention harvests in the Pacific Northwest: A review of short-term findings from the DEMO study. Forest Ecology and Management.

[125] In a draft legislative concept paper, Senator Ron Wyden (D-OR) proposes to define "old growth" in moist forest types as >120 years of age. Wyden, Ron. 2008. http://wyden.senate.gov/forestproposal/WydenDraftForestRestorationProposal.pdf. Wyden Draft Forest Proposal. Office of Senator Ron Wyden, United States Senate. While this political definition of "old growth" includes some mature forest, it leaves significant areas of mature forest unprotected.

The bottom line is this: If our policies protect all mature and old-growth forest, *more* timber will get to the mills than if our policies leave some mature forest theoretically available for logging. If we don't take *all* mature forests off the table, the Forest Service and BLM will continue to try to sell controversial mature forest timber sales, and the timber industry will continue to try to log it. Public and judicial controversy will continue, precluding collaboration between the conservation community, timber industry and federal forest agencies. The ideal forest policy will steer the agencies away from controversial logging of mature forests and trees and steer them instead toward science-based restoration; variable density thinning of monoculture plantations; and, removing surface and ladder fuels from fire-suppressed dry ponderosa pine and dry mixed-conifer forest types to conserve and restore old-growth conditions.

Mature forest logging on the Willamette National Forest.

Visual comparison of logged and unlogged mature forests.

Mature forests are beautiful.

Standing under the canopy of a mature forest, one gets the distinct feeling that *this beautiful place should not be destroyed by logging.* Each year that feeling gets stronger, both as the forest becomes more complex and as society evolves. The National Commission on Science for Sustainable Forestry reported that "the high social value placed on older forests in [the Pacific Northwest] grows from recognition of the recreational and aesthetic opportunities that they offer as well as their ecological importance. … Another study recommended that large, mature trees should be retained in forest thinning projects because they are an important part of scenic beauty."[126]

Practical Reasons to Protect Mature Trees and Forests

Complicated environmental analyses will be required to justify logging mature forests compared to less controversial thinning of young plantations.

Since mature forests can harbor late successional wildlife, logging will trigger expensive and time-consuming wildlife surveys. More detailed Environmental Impact Statements (EISs) will often be needed instead of relatively abbreviated Environmental Assessments (EAs). Formal instead of informal consultation under the Endangered Species Act will more often be triggered.

Clear rules work better than discretion.

History shows that when the agencies are given ambiguous rules discretion will be abused, which leads to ecological harm and fuels distrust of the agencies. When rules are clear and unambiguous, and when there are practical ways for the public to hold the agencies accountable, the agencies will avoid pitfalls and have more success. There may well be instances when stands

[126] NCSSF 2008. Beyond Old Growth Older Forests in a Changing World - A synthesis of findings from five regional workshops. National Commission on Science for Sustainable Forestry. http://ncseonline.org/00/Batch/NCSSF/BOG/OldGrowth_final%203.10.08.pdf

older than 80 years could benefit from thinning or when trees older than 120 years could be removed from dry forests, but those are exceptional circumstances that do not refute the overwhelming value of clear rules. There may be ecological sacrifices associated with those exceptional circumstances when thinning is disallowed, but those will be minor compared to the significant harm that would result from excessive discretion. In short, the large problems created by excessive discretion far exceed the small problems created by unambiguous rules. This was implicit in the 1993 report of Scientific Analysis Team discussed above under the subsection "moist forests … need time, not logging." The SAT report highlighted the risks of pushing the envelope and allowing logging in questionable cases, including that the agencies' mitigation plans are not always carried out, contracts are not fully implemented and enforced, and the agencies lack the funds and commitment to monitor and change practices that need improvement.[127]

"Predictable timber supply" is an oxymoron.

Setting policy that tries to establish and produce a predictable timber supply has failed again and again. This is especially true when, as here in the northwest, we are trying to squeeze blood out of a turnip. These forests are already suffering from decades of unsustainably high logging rates, and there are numerous listed species that need more protection, not another short-sighted push for volume.

Don't misinterpret this point. There is significant timber production from NW federal forests. Between 1995 and 2005, the Forest Service and BLM auctioned over 5.7 billion board feet of timber (representing over 1 million log truck loads) within the Northwest Forest Plan area. Parked bumper-to-bumper, one million log trucks would stretch over 10,000 miles. Timber production is occurring; it's just not as predictable as some would prefer, yet that is an unavoidable consequence of our a complex, dynamic social system trying to manage these complex, dynamic ecosystems that we are still struggling to fully understand.

Jack Ward Thomas, former Chief of the US Forest Service, wrote a piece that put the inherent uncertainty of timber targets in perspective.

> The vision that I was taught in school of the "regulated forest" and the resultant predictable outputs of commodities has turned out to have been a dream. And a dream that could only be realized in a time of seemingly boundless virgin forests. This vision held only so long as, no matter what the circumstances, there was more timber available over the next ridge. And, that timber was relatively cheap--easy to access and log--and environmental risks were either less appreciated or more palatable than at present. Further, it was assumed that good forestry was--as a matter of course--good wildlife management, good watershed and management, etc.

[127] SAT Report, pp 147-151.

> By now it is becoming obvious that this dream was built on the pillars of the seemingly boundless virgin forest and an ethic of manifest destiny coupled with hubris of being able to predict the response of nature and humans. This was coupled with an inflated sense of understanding of forested ecosystems and of human control. Perhaps it is time to recognize that such stability is not attainable .
>
> … So, stability in timber supply from the public lands is simply a myth, a dream that was never founded in reality. It is time to stop pretending.[128]

Some of these uncertainties can be managed by focusing on truly non-controversial restoration projects. Going forward, a modest supply of wood products can be provided from federal lands, but it must be a by-product of restoration. Management goals must be framed in terms of restoration accomplishments, not volume targets.

Economic Reasons to Protect Mature Trees and Forests

Avoided carbon emissions equals avoided climate mitigation costs.

It will be very expensive to address climate change once it is in full swing, so it makes economic sense to store carbon in mature forests. Economists estimate that the cost of avoiding emissions is far less than the cost of responding after the fact.[129] Several studies have shown that changing forest practices is one of the more efficient and economical ways to store carbon and reduce emissions.[130] In a review of recent research regarding the economics of forest carbon storage, the authors concluded: "it appears that carbon sequestration may play a substantial role in a global greenhouse gas emissions abatement program. In the cost range of 10 to 150 dollars per ton of carbon it may be possible to sequester 250 to 500 million tons per year in the United States, and globally upwards of 2,000 million tons per year, for several decades."[131]

Given that carbon storage is just one of many important ecological services provided by mature and old forests —adding to the already well-recognized value of clean water, biodiversity, nutrient cycling, hydrologic buffering, slope stabilization, and quality of life— every effort should be made to avoid as much warming as we can by protecting mature forests.

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[128] Jack Ward Thomas, The Instability of Stability, http://web.archive.org/web/20001201174000/http://coopext.cahe.wsu.edu/~pnrec97/thomas2.htm

[129] Kenneth J. Arrow, "The case for mitigating greenhouse gas emissions", real-world economics review, issue no. 45, 15 March 2008, pp. 66-67, http://www.paecon.net/PAEReview/issue45/Arrow45.pdf ("A straightforward calculation shows that mitigation is better than business as usual – that is, the present value of the benefits exceeds the present value of the costs – for any social rate of time preference less than 8.5%.")

[130] McKinsey & Company. 2009. Pathway to a Low Carbon Economy - Version 2 of the Global Greenhouse Gas Abatement Cost Curve. http://globalghgcostcurve.bymckinsey.com/default.aspx

[131] Kenneth R. Richards And Carrie Stokes. 2004. A Review Of Forest Carbon Sequestration Cost Studies: A Dozen Years Of Research. Climatic Change 63: 1–48, 2004. http://www.springerlink.com/content/p21n67k61417871l/fulltext.pdf

The timber industry does not need to log mature forest to provide jobs.

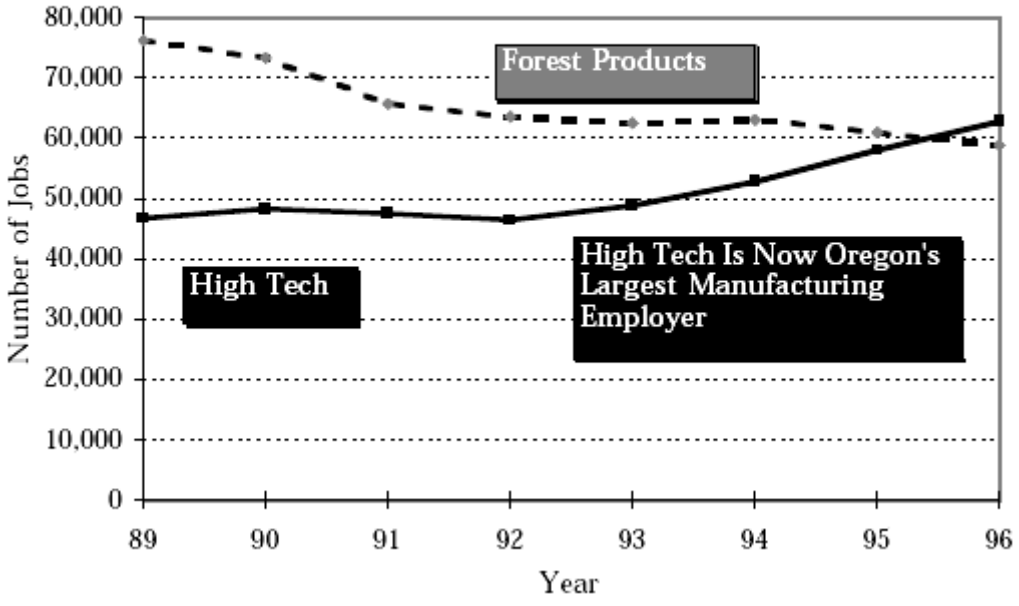
Less than 2% of the jobs in Washington and Oregon are in the lumber and wood products sectors. Only a small fraction of those jobs are on federal land, and only a small fraction of those jobs are dependent upon logging mature forests. Many more environmentally benign jobs are available in restoring roads and streams, thinning young plantations, and managing for water, fire, carbon, and recreation.

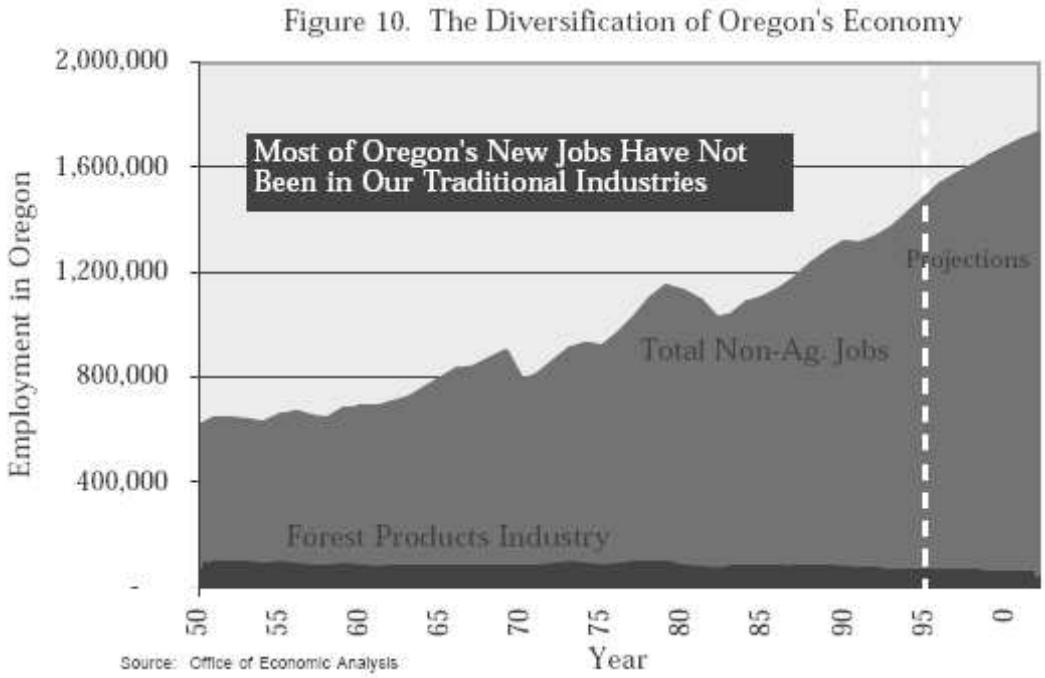
Logging mature forest is not needed to prop up the economy.

The timber industry represents a small and shrinking portion of the northwest's growing economy. The timber industry has been declining since long before the current economic downturn, while other industries have grown, and these trends are likely to continue. Economic development strategies should focus on other sectors that are poised for growth. The Pacific Northwest economy has greatly diversified in the last decade. During the 1990s the Pacific Northwest economy typically created more new jobs every year than exist in the entire lumber and wood products sectors.

Timber is a small and diminishing share of the NW economy, and on top of that, productivity increases mean that over time fewer jobs are created per volume of timber produced, so the net benefits to the economy of a given logging level continue to decline.

Figure 9. Employment Trends in the Forest Products and High Tech Industries





[Source: Oregon Shines II. http://www.oregon.gov/DAS/OPB/docs/osII.pdf]

Logging mature forest is not needed to prop up the timber industry.

Less than 10% of the logging in Oregon and Washington in recent years has been on federal forest lands. Only a fraction of that is represented by logging of mature forests. Much more environmentally benign and socially acceptable timber volume can be derived from thinning young plantations or small diameter fuel reduction where ecologically appropriate. The timber industry in the northwest is more and more reliant on logging non-federal forest lands. This is appropriate, because the timber industry controls a large and productive land base and the highest and best use of our federal forests is to provide public goods that are not well-provided on non-federal lands, such as clean water, habitat, biodiversity, carbon storage, recreation, soil conservation, flood control, nutrient cycling, etc.

What's good for the timber industry might not be good for the economy as a whole.

The timber industry tends to boom and bust, which has harmful repercussions on the rest of the economy. These cascading adverse effects are amplified or dampened depending on the timber industry's share of the overall economy. When the timber industry grows, the rest of the economy faces increased strain from the boom/bust cycle. On the other hand, policies which help the timber industry rescale to match the smaller housing and construction markets will inherently help stabilize the northwest economy.

Fierce global competition in the wood products sector also places downward pressure on wages and benefits. Technological changes in the timber industry mean that timber harvest can increase while employment and wages decrease. Real wages in sawmills decreased by 17% between 1979 and 1989. According to the Oregon Progress Board, "There is no great job 'recovery' in sight for

Oregon's primary wood products industry. Oregon Department of Forestry predicts that current low harvest levels will not increase in the future, and are likely to stabilize at near their current levels."[132] Although this report is almost ten years old, it's prediction has proven to be accurate and remains valid for the future as well.

Mature Forests Enhance Quality of Life and Help Diversify the NW Economy.

The state should be looking for economic development opportunities that focus on growth industries like technology, information, and environmentally sustainable energy, instead of focusing on extractive industries. According to the Oregon Progress Board,

> A recent report endorsed by over 60 Northwest economists noted that Oregon's economy has been remarkably healthy and vibrant over the same decade that declines in the wood products industry were pronounced. They attribute much of the region's economic growth to the ability of its natural beauty to attract new business, and they suggest policies to preserve forests and attract high technology.[133]

It would be wise to invest in forest restoration and related initiatives that yield significant returns of ecosystems services and quality of life that attracts skilled workers and the companies that hire them. The Oregon Economic Development Department has long recognized that our magnificent forests offer a significant comparative advantage for Oregon's tourist industry, and it recognizes the need for the state to help the timber industry transition from logging old growth to younger stands.[134]

Conclusion

Congress and policy-makers at all levels should recognize the myriad ecological, social, practical, and economic reasons to protect old-growth AND mature forests. There is much work to be done in our federal forests: storm-proofing and removing roads, rehabilitating streams, managing fire, maintaining and enhancing recreation facilities, as well as thinning dense young stands and removing small surface and ladder fuels from dry forest suffering from fire exclusion. If done carefully, this restoration agenda will help protect and enhance ecosystem services like clean water, carbon storage, biodiversity, nutrient cycling, hydrologic buffering, and slope stability. It will also create jobs and provide a modest amount of wood products. Let's get to work.

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[132] Oregon Progress Board. 1997. Oregon Shines II: Updating Oregon's Strategic Plan, A REPORT TO THE PEOPLE OF OREGON, January 21, 1997. http://www.oregon.gov/DAS/OPB/docs/osII.pdf

[133] Oregon Progress Board. 1997. Oregon Shines II: Updating Oregon's Strategic Plan, A REPORT TO THE PEOPLE OF OREGON, January 21, 1997. http://www.oregon.gov/DAS/OPB/docs/osII.pdf

[134] OEDD. May 1989. Oregon Shines: An Economic Strategy for the Pacific Century. http://www.oregon.gov/DAS/OPB/docs/OS_PartIISection3.pdf, page II-58