

ANALYSIS



TOP TEN CARBON STORING NATIONAL FORESTS IN AMERICA

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INTRODUCTION

National forests, national parks and other federally-owned forests in the Pacific Northwest and Southeast Alaska hold extraordinary amounts of carbon and therefore play an important role in defending against climate change. According to United States Forest Service data¹, the ten national forests in the United States that store the most carbon per forested acre are all located in western Oregon, western Washington and southeast Alaska. Moist late-successional forests west of the Cascade Range mountains are among the Earth's greatest carbon storing ecosystems.²

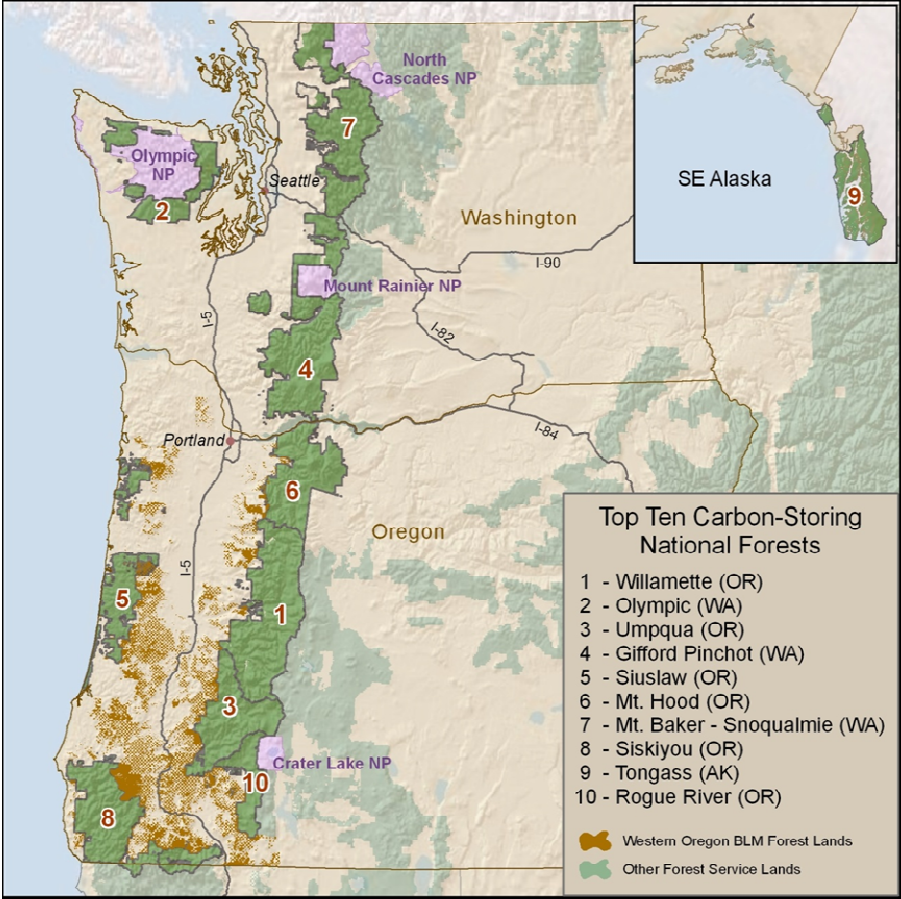


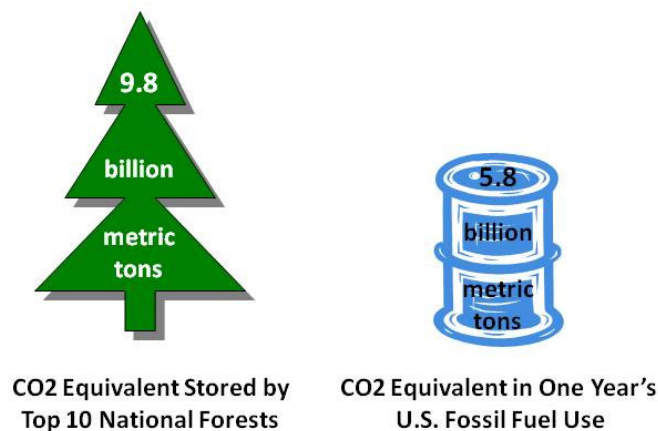
Table 1: Top Ten Carbon Storing National Forests

National Forest (and state)	Metric Tons of Carbon/ Forested Acre	Metric Tons of CO ₂ Equivalent/Forested Acre
Willamette (OR)	164	601
Olympic (WA)	159	584
Umpqua (OR)	159	584
Gifford Pinchot (WA)	152	557
Siuslaw (OR)	152	557
Mt. Hood (OR)	150	550
Mt. Baker-Snoqualmie (WA)	143	526
Siskiyou (OR)	135	494
Tongass (AK) ³	127	466
Rogue River (OR)	127	466

The ten national forests in the U.S. with the highest carbon density — Willamette, Olympic, Umpqua, Gifford Pinchot, Siuslaw, Mt. Hood, Mt. Baker-Snoqualmie, Siskiyou, Tongass and Rogue River — hold an average of approximately 500 metric tons of carbon-dioxide-equivalent (CO₂e) on each forested acre.

Altogether, these forests store approximately 9.8 billion metric tons CO₂e on about 19 million acres. Some of this carbon is stored in living trees and other vegetation, both above and below ground, some in standing or down dead wood, and some in soil. The amount of CO₂e stored in these forests can be better understood by comparing it to the CO₂e stored in all the fossil fuels that are burned in the U.S. over a year - about 5.8 billion metric tons.

CHART 1. Carbon in Ten Most Carbon-Dense National Forests, Compared to Carbon in Fossil Fuels Burned in the U.S. Each Year



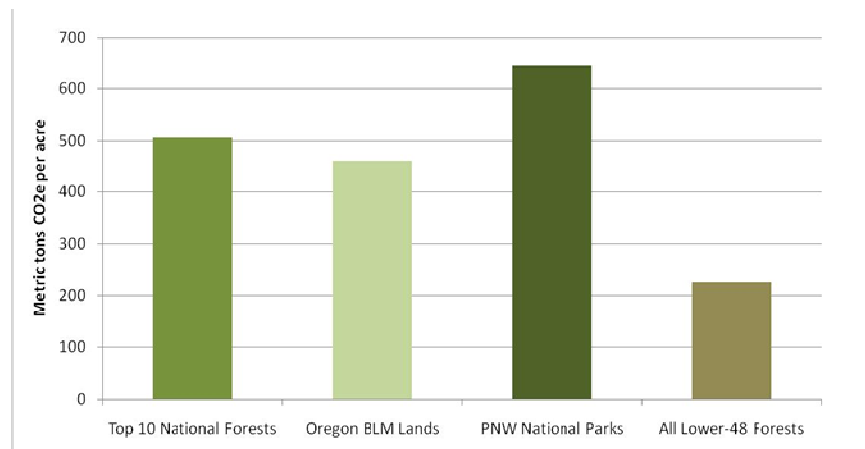
National parks in Washington and Oregon — North Cascades, Olympic, Mt. Rainier and Crater Lake — store even more carbon per acre than the national forests — an average of 644 metric tons of CO₂e per forested acre, with the highest amounts in Olympic National Park (800 tons).

Significant carbon stores are also found in the 2.5 million acres of federal forests administered by the Bureau of Land Management (BLM) in western Oregon. The BLM western Oregon forest lands store an average of about 460 metric tons CO₂e per acre, or a total of 1.2 billion metric tons CO₂e on 2.5 million acres.

National forests in California also store large amounts of carbon. The Six Rivers National Forest in northern California holds an average of 418 metric tons CO₂e per acre, while six other forests in the state store more than 300 metric tons of CO₂e/acre.

To indicate how special these carbon-rich forests in the Pacific Northwest and Alaska are, all forests across the entire lower 48 states hold an average of about 230 metric tons CO₂e/acre.

CHART 2. Average Carbon Density of Forested Acres



For international comparison, global tropical forests store an average of 360 to 460 metric tons of CO₂e per acre, boreal forests 430 to 600 metric tons of CO₂e (mostly in the soil) and temperate forests 220 to 420 metric tons of CO₂e.⁴

OLD GROWTH AND MATURE FORESTS

Old growth and mature forests are especially important for their carbon stores. Studies of Washington's Wind River old growth forest in the Gifford Pinchot National Forest, for instance, found carbon stocks of over 900 metric tons CO₂e per acre.⁵ The forest-wide estimates presented above are based on Forest Inventory and Analysis plots and models derived mainly from managed forests. Therefore, modeling methods may fail to fully reflect the large dead wood, forest floor and soil carbon pools commonly found in many old growth and mature forests.⁶

The old growth and mature forests of the Pacific Northwest and Southeast Alaska are playing an important role in long-term carbon sequestration. In addition, they are able to retain and continue to increase their carbon stores for centuries, due to their relatively long fire-return intervals.⁷

Even though they are one of the greatest carbon banks on Earth, one million acres of the carbon-rich and resilient federal forest lands on the west side of the Cascade Range mountains in the Pacific Northwest are not formally protected and therefore are potentially vulnerable to destructive logging.⁸

Federal forest lands in western Oregon have been particularly threatened by the BLM's past efforts to increase timber production on those lands. The Western Oregon Plan Revisions (WOPR) in 2008 sought to triple timber production from the BLM forests. On July 16, 2009, Secretary of the Interior Ken Salazar withdrew the WOPR and directed the BLM to identify ecologically sound timber sales consistent with the Northwest Forest Plan.

The future of many old growth and mature forests in Alaska's Tongass National Forest is also in doubt. The Forest Service's 2008 revised land management plan for the Tongass would allow 400,000 acres of productive old growth to be logged. The agency is currently deciding whether to proceed with several large old growth timber sales.

In conclusion, federal forests in the Pacific Northwest and Southeast Alaska — especially the old growth and mature forests — store tremendous amounts of carbon that are vitally important to America's ability to combat climate change. This wealth of forest carbon should be protected as a natural and national asset along with the many other important services that healthy forests provide — from clean water to wildlife habitat.

¹Data presented are from the Carbon On-Line Estimator (COLE) developed by the USDA Forest Service and the National Council on Air and Stream Improvement and are available at <http://ncasi.uml.edu/COLE>. Like the Consumer Price Index or the unemployment rate, COLE's carbon storage numbers are based on a sample of on-the-ground data, and there is a margin of error around these estimates. The numbers reported here should therefore not be interpreted as exact measures of how much carbon these national forests currently hold, but rather an indication of their relative importance as carbon storehouses among the entire National Forest System. For a detailed evaluation of COLE and other available tools for estimating forest carbon, see Ingerson, A. and W.M. Loya. 2008. *Measuring Forest Carbon: Strengths and Weaknesses of Available Tools*. The Wilderness Society: Washington, DC. 20 p., available at <http://wilderness.org/files/Measuring-Forest-Carbon.pdf>.

²Smithwick et al. 2002. Potential upper bounds of carbon stores in forests of the Pacific Northwest. *Ecological Applications* 12, 1303-1317.

³The models employed for the COLE have not been fully tested for application to Alaskan forests, giving COLE estimates for the Tongass greater uncertainty than those estimates of forests in the contiguous U.S. A case study of the Tongass (Leighty, W. W., Hamburg, S.P, and Caouette, J. 2006. *Effects of Management on Carbon Sequestration in Forest Biomass in Southeast Alaska*. *Ecosystems* 9: 1051–1065) that incorporated different methods suggests carbon density may be greater than those presented here.

⁴Intergovernmental Panel on Climate Change. 2001. *Third Assessment Report, Working Group 1, Chapter 3*.

⁵Harmon, M.E., Bible, K., Ryan, M.G., Shaw, D.D., Chen, H., Klopatek, J. Li, X. 2004. Production, respiration, and overall carbon balance in an old-growth *Pseudotsuga-Tsuga* forest ecosystem. *Ecosystems* 7: 498-512.

⁶Likewise, the international estimates of carbon stores by forest type fail to highlight the world's real gems of carbon storage. For example, a recent study of Australia's native eucalyptus forests found carbon stocks as high as 950 metric tons CO₂e per acre. Mackey, B.G., Keith, H., Berry, S.L. and Lindenmayer, D.B. 2008. Green carbon : the role of natural forests in carbon storage. Part 1, A green carbon account of Australia's south-eastern Eucalypt forest, and policy implications. Canberra, Australia: The Australian National University. Online version available at: http://epress.anu.edu.au/green_carbon_citation.html.

⁷Luyssaert, S., Schulze, E.D., Borner, A., Knohl, A., Hessenmoller, D., Law, B.E., Ciais, P., and Grace, J. 2008. Old-growth forests as global carbon sinks. *Nature* 455, 213-215.

⁸Forest Ecosystem Management Assessment Team. 1993. *Forest ecosystem management: an ecological, economic, and social assessment*. No. 1993-793-071. U.S. Government Printing Office, Washington, D.C. USA.

ABOUT THE AUTHORS

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ABOUT THE WILDERNESS SOCIETY

Since 1935, The Wilderness Society has led the conservation movement in wilderness protection, writing and passing the landmark Wilderness Act and winning lasting protection for 109 million acres of Wilderness, including 56 million acres of spectacular lands in Alaska, eight million acres of fragile desert lands in California and millions more throughout the nation. It is our calling and our passion to protect America's wilderness, not as a relic of our nation's past, but as a thriving ecological community that is central to life itself. To meet our goals, we use science and collaboration with communities and conservation groups to bring about sensible policies and positive change in land conservation.

The Wilderness Society's Research Department consists of experts in economics, ecology and landscape analysis, including 12 Ph.D.-level scientists. This outstanding team provides the science to answer pressing questions about mineral exploration and development, forest and fire management, climate change, and many other issues affecting public lands.

Our mission: *to protect wilderness and inspire Americans to care for our wild places.*
