



IMPORTANCE

Mature and old-growth forests are icons of the Pacific Northwest. In the parks of the North Coast and Cascades Inventory and Monitoring Network (NCCN) forests range from coastal rainforests with massive trees draped with mosses and ferns and surrounded by dense understories; to areas with drought-adapted Ponderosa pines; to high-elevation subalpine fir forests interspersed with meadows just below treeline. These forests, in turn, are the foundation for other biotic communities constituting Pacific Northwest ecosystems.

Climate change, air pollution, invasive species and other stressors threaten forest structure, species composition and abundance, thereby threatening the quality and quantity of habitat for terrestrial birds and wildlife. In particular, climate change and air pollution are expected to be the greatest threats to national parks in the Pacific Northwest. Changes in forest structure and composition will also alter the chemistry of water moving from terrestrial to aquatic systems. Consequently, forest monitoring is a fundamental part of the overall monitoring plan for the parks of NCCN. Tree recruitment, growth, and mortality are sensitive indicators of ecological change that can only be documented and understood through detailed, long-term observations. Increases in tree mortality have recently been reported for western North America, demonstrating the utility of long-term forest monitoring.

CONTACT: Steve_Acker@nps.gov

Monitored at:

[Lewis and Clark National Historical Park](#)

[Mount Rainier National Park](#)

[North Cascades National Park Service Complex](#)

[Olympic National Park](#)

[San Juan Island National Historical Park](#)



Olympic National Park employee Patrick Loafman measuring a Douglas-fir tree at a long-term monitoring plot in the Elwha watershed, Olympic National Park. Photograph courtesy of Olympic National Park.

STATUS and TRENDS

The NCCN monitoring program has established 35, 1-hectare plots at Mount Rainier, North Cascades, and Olympic, at elevations from sea-level to 1800 meters. Plots established to date include 21 tree species, representing most of the diversity of species in the parks. Additional plots will be established at San Juan Island and Lewis & Clark in the next few years. The specific forest types selected capture the extremes and the middle of the temperature and precipitation gradients for forests in the network. Sitka spruce forests at Olympic and Lewis & Clark comprise the warm and wet end of the gradient. These forests are important winter feeding grounds for Roosevelt Elk. The cold and dry end of the gradient consists of subalpine fir forests at North Cascades and Mount Rainier. The middle of the gradient is represented by western hemlock with a salal and/or Oregon grape understory, measured at Mount Rainier, North Cascades, and Olympic. These forest types are common throughout the region and monitoring results will provide benchmark information for managed forests. Target vegetation communities for San Juan Island have not yet been identified.

Tree mortality will be assessed annually and tree recruitment and growth will be recorded every five years. Trends in tree mortality will be reported every year, starting in the fourth year (2011). Trends in tree recruitment and growth will be reported after 15 years and trends in stem densities and tree basal area will be reported after 10 years.

DISCUSSION

A recent report in the journal *Science* estimated that in recent decades the rate of tree mortality in old-growth forests in the Pacific Northwest has doubled every 17 years, probably due to regional warming and consequent stress caused by drought. This could lead to fewer large trees, less carbon storage, and forests predisposed to abrupt dieback. Forest monitoring in NCCN will determine whether or not the recently-observed trend in tree mortality is continuing, as well as provide information about changes from historic conditions and the type of habitat the forests provide for other plants and animals, the forest's ability to capture CO₂, susceptibility to pests and pathogens, and other information that will assist managers in protecting the forests and related park ecosystems.

