Yellow-Cedar Decline

Developing a management strategy for a tree impacted by climate change

Research & Development

Key Message

Yellow-cedar, an exceptional and typically long-lived tree, has been dying on over one-half million acres for the past 100 years in Southeast Alaska. Forest-wide conservation and management strategies for yellow-cedar are being developed based on new knowledge on the cause of yellow-cedar decline, associations with climate change, information from remote sensing and mapping, promising results on the value of wood from dead trees, and experience with regeneration planting.

Issue

Yellow-cedar, sometimes called Alaska-cedar, is a culturally and economically important tree in Southeast Alaska. A widespread tree mortality problem that is associated with current climate change complicates the management of this tree, but it also offers opportunities for recovering valuable wood from dead forests. Information from more than 20 years of research on tree biology and the decline problem, as well as silvicultural experience with the tree, is guiding yellow-cedar management in the context of a warming climate in Southeast Alaska.

Current Situation

Yellow-cedar has long been culturally important to Native people of Southeast Alaska. The great strength and durability of its wood also help make yellow-cedar the most valuable commercially grown wood in Alaska. However, this exceptional, typically long-lived tree has been dying at an alarming rate on over 500,000 acres for the past 100 years. The onset of tree mortality coincided with the end of the Little Ice Age and the beginning of climate warming in the late 1800s. Both warming and yellow-cedar mortality accelerated in the latter half of the 1900s, leaving 70 to 90 percent of cedar dead in these forests. The extreme decay resistance of yellow-cedar's wood allows dead trees to remain standing, and a potentially valuable timber resource, for about 80 years after death.

Results from studies on wood properties of dead yellow-cedar demonstrate promising opportunities for salvage recovery. For trees dead up to 30 years, wood volume and grade recovery, deterioration, and concentration of heartwood chemical compounds were all comparable to wood from live trees. Only modest reductions in these values were detected in wood from trees dead 80 years. Remarkably, all strength properties were retained, even in wood from trees dead up to 80 years.

New information from a range of studies indicates that trees die by a form of spring freezing injury triggered by premature dehardening caused by the lack of insulating snow over the tree's roots. Trees were reproducing and growing well in the colder, snowier period of the Little Ice Age, and they continue to thrive in the colder regions and higher elevations of Southeast Alaska

where spring snow offers protection from dehardening and freezing. The close association between tree health and snow, coupled with projections of further climatic warming, help guide decisions about where to favor planting and thinning of yellow-cedar in the future.

Planting projects using yellow-cedar seedlings on the Wrangell Ranger District and Ketchikan Ranger District show that yellow-cedar can be successfully regenerated. Yellow-cedar regeneration grows well on productive, drained soils where decline does not occur because deeper rooting and canopy shading protect the tree. On wetter soils, yellow-cedar can be promoted in colder winter regions and at higher elevations where snow offers protection.

This collaborative yellow-cedar project is led by U.S. Forest Service State & Private Forestry and the Pacific Northwest Research Station, with assistance from several ranger districts on the Tongass National Forest, The Nature Conservancy, University of Alaska Fairbanks, University of Vermont, Northeast Research Station, and others. Current activities include snow and climate modeling to identify areas suitable for yellow-cedar. Remaining information gaps and experience critical to yellow-cedar management include longer-term plant succession in declining forests (i.e., transition to other tree species), wildlife use of cedar snags, marketing of dead yellow-cedar wood, genetic improvement of planting stock that is cold-hardy in spring, and general silvicultural techniques to establish and manage young-growth yellow-cedar forests.

Summary

Yellow-cedar decline represents one of the best examples worldwide for how a minor shift in climate has had serious and unanticipated consequences in forest ecosystems. Managing long-lived forest trees in a changing climate is challenging but also essential because Alaska has so few tree species. Research and development on yellow-cedar decline have progressed to the point where we can propose a strategy to simultaneously conserve and actively managed yellow-cedar by:

1. Identifying the current and future distribution of yellow-cedar decline through remote sensing and climate and landscape modeling.
2. Shifting some timber harvesting to the decline-impacted forests where wood properties of dead trees are largely retained and, regardless of salvage, forests are transitioning away from yellow-cedar.
3. Promoting the regeneration and growth of yellow-cedar in forests that are not currently declining nor are projected to be declining in a warming climate.

More Information

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