Northwest Reforestation Workshop: Choosing plant materials suited to current and future climates

Photo by: Tom Brandt

Case study: Post-harvest reforestation in a coastal forest in southwestern Washington

USDA Northwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Management goals | Restoration of a young, managed forest to accelerate development to old-growth; comparison of performance of local seed sources to sources from drier climates

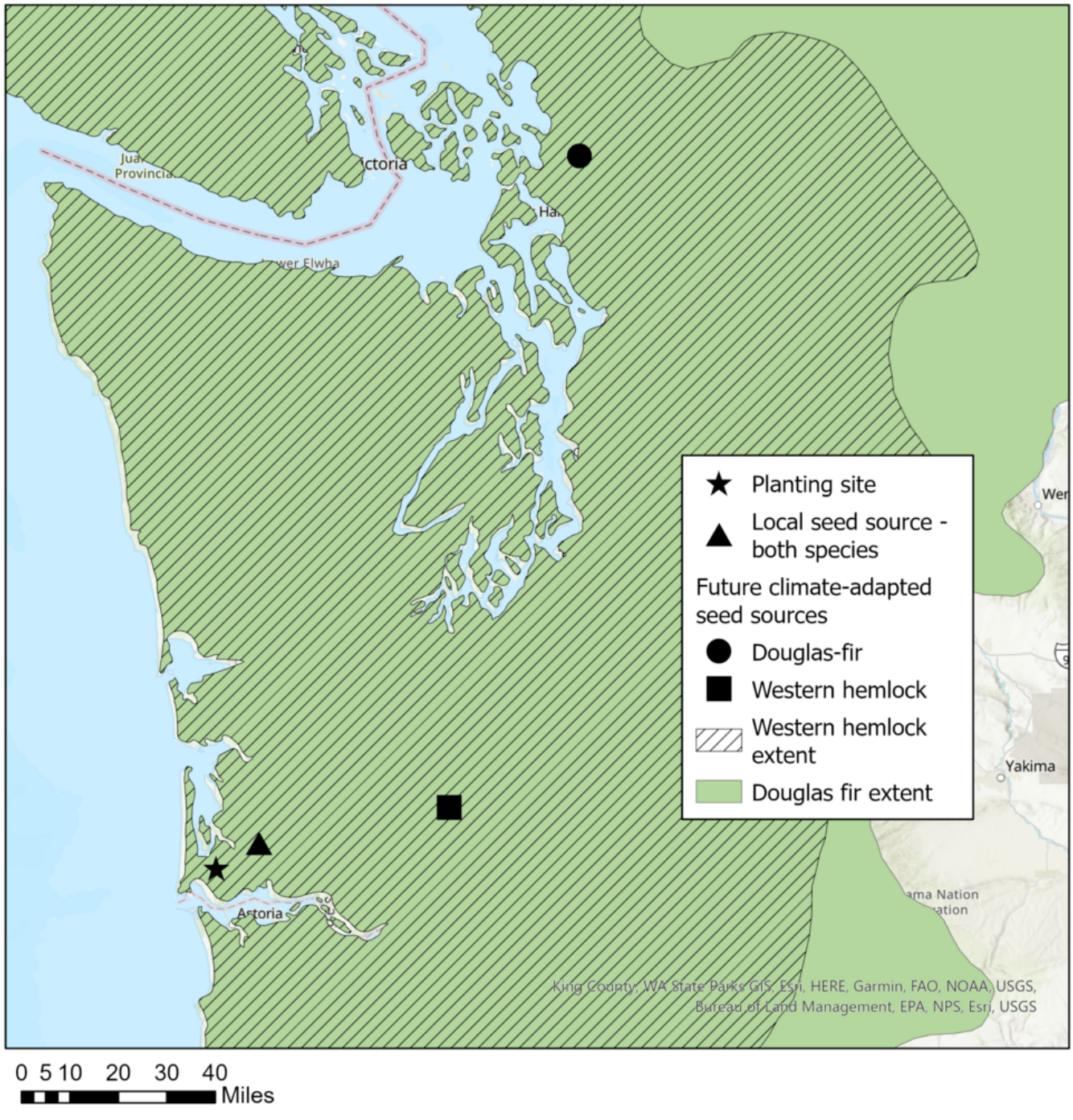
Audience | Forest managers and silviculturists

Project lead | Michael Case, Forest Ecologist, The Nature Conservancy – Washington Chapter

Project area | Ellsworth Creek Preserve, Willapa Hills of southwestern Washington

Organization | The Nature Conservancy

Funding sources | Internal funds, including volunteer and in-kind time



Planting site in the Ellsworth Creek Preserve and seed source locations for local and non-local (future climate-adapted) populations of Douglas-fir and western hemlock.

Site Context

The planting was conducted on The Nature Conservancy's (TNC) Ellsworth Creek Preserve, located in the Willapa Hills of coastal southwestern Washington. The site is located on the first major ridge inland from the Pacific Ocean at approximately 1,000 feet. Temperatures are moderate, averaging 39° F in winter and 58° F in summer. The site receives an average of 120 inches of precipitation per year, with over 90% falling between October and June. Prior to acquisition by TNC, the site was used for timber production of Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and Sitka spruce (*Picea sitchensis*), with the most recent clearcut occurring in 2015. Following its purchase in 2020 by TNC, the area was identified as a research site with the objective of comparing growth and survival of western hemlock and Douglas-fir seed sources from local and historically drier climates. This project is expected to inform TNC's broader goal of restoring forests and building resilience to climate change. Identifying the species and seed sources that can survive and grow rapidly under expected future climate conditions is key to achieving this management goal.

Clearcut stand in Ellsworth Creek Preserve prior to planting. Photo credit: Michael Case

Implementation

Selection of material for planting consisted of several steps. Many species were considered for planting at the site, including several species not native to southwestern Washington. These included coast redwood (*Sequoia sempervirens*), golden chinquapin (*Chrysolepis chrysophylla*), Oregon myrtle (*Umbellularia californica*) and coast live oak (*Quercus agrifolia*). Two seed sources each of Douglas-fir and western hemlock were eventually selected for planting. This decision resulted primarily because of stock availability at the Washington Department of Natural Resources (WA DNR) Webster Nursery, from which the seedlings were sourced. Additionally, the team was more comfortable with planting native species from seed sourced from outside the study area (assisted population migration) than planting non-native species not historically present in the region (assisted species migration). For both species, a local seed source was selected to reflect adaptation to the historical (1961-1990) local climate (Table 1). The second seed source for each species was selected to represent a drier source climate, specifically a

10 – 15% decrease in summer precipitation. Decreases in moisture availability during the summer are expected and may become more limiting to tree growth than changes in temperature in coastal areas. Although the Seedlot Selection Tool was referenced during the implementation process, it was not formally used during the selection process. The Seedlot Selection Tool does show the variables mean summer precipitation and summer heat moisture index (SHM), which combines summer temperature with precipitation, so the tool could be used for this planting objective (Table 1). Selection of the second (non-local) seed source for each species was informed by multivariate climate analyses conducted by the project team, expert opinion from forest managers in the region, and seedling availability at the nursery.

Table 1. Characteristics of and source climate of seed sources selected for planting in Ellsworth Creek Preserve project area. Note that non-local seed sources are adapted to greater summer heat moisture index and lower summer precipitation than local seed sources.

Species	Seed source elevation	Seed source zone	Mean Summer Precipitation (mm)	Summer Heat Moisture Index (SHM)
Douglas-fir	0 – 1000'	Twin Harbors (local seed source)	491	51.2
Douglas-fir	0 – 1000'	Islands (NE of planting site)	252	85.7
Western hemlock	0 – 1200'	Twin Harbors (local seed source)	374	48.4
Western hemlock	0 – 1200'	Upper Chehalis (inland of planting site)	61.8	231

Challenges and Opportunities

As noted above, this project was constrained by the plant materials that were available through the nursery at the time of project implementation, limiting the species and seed sources considered for planting. The resources allocated to starting this project were limited, which led to several issues with project execution. Reliance on volunteer time and in-kind support from employees with many projects to juggle resulted in rushed planning leading up to planting. Additional time dedicated to planning would have allowed the team to be better prepared in terms of time and materials needed. Further, volunteer hours and in-kind time were not tracked. The project team plans to track personnel time spent on all future projects, as this information is key in budgeting for future work. In addition to the time required in the lead-up to the planting, a significant amount of time for site maintenance has been required following planting to ensure seedling success. The project team has conducted annual removal of competing vegetation, primarily consisting of resprouting conifers cut during site preparation. This site maintenance requires substantial time that was not initially scheduled or budgeted for the project.

Project area with planting area in blue. Map credit: Michael Case

Future Plans

Since planting the site, the project team has been loosely monitoring seedling survival through annual site visits. However, the measurement of height and survival of all seedlings is planned for 2025, five years following planting. Continued monitoring of seedling survival and growth is expected, though the timing and funding sources for subsequent measurements have not been determined. Annual vegetation control is also expected to continue until the seedlings represent the dominant vegetation on the site. Weather stations capable of capturing fine-scale differences in climate due to topographic features were also installed at the site in collaboration with University of Washington researchers and will contribute to understanding the effects of variation in microclimate on seedling performance.

Planted Douglas-fir seedling from seed source adapted to future climate. Photo credit: Michael Case