



Nisqually Community Forest Case Study: Snow Gaps and Assisted Migration

Quick Facts

Location:

Near Ashford, WA (Pierce County)

Project Size:

140 acres

Forest Type:

Conifer forest primarily dominated by Douglas-fir, silver fir, and western hemlock

Soil Type:

Well-drained volcanic ash-derived soils typical of the Cascades west slope

Stand Age:

Primarily between 30 to 50 years old

Project Objectives

- Thin to reduce stand density, spreading soil moisture among fewer trees and improving drought resilience.
- Install “snow gaps” — 0.5 to 1 acre openings in the canopy — to increase snow accumulation and extend snowmelt into the dry season.
- Plant seedlings from warmer, drier seed zones to establish locally adapted seed sources for future forest regeneration.
- Safeguard long-term forest recovery toward mature, structurally complex stands valuable for wildlife.
- Enhance headwater streamflow for amphibians and aquatic life by prolonging spring meltwater inputs.

Project Overview

At the Nisqually Community Forest (NCF), NNRG and other Nisqually watershed partners are testing techniques that can help forests better endure the kinds of climatic changes that we expect in the Pacific Northwest.

These include:

1. Thinning the forest to spread available soil moisture among fewer trees,
2. Installing snow gaps so that more snow accumulates and extends snowmelt season, and
3. Planting seedlings from warmer zones to provide a local source for adapted genetic traits.

The techniques were used on formerly industrial forests, and are part of our overall plan to restore the forest while also making it more resilient to the predicted future climate in the area.

Beginning Conditions and Background

The starting point for this work was a landscape shaped by decades of industrial timber harvest, primarily through clearcutting and replanting to dense, single-species stands. By the time the Nisqually Community Forest acquired the land, the forest was uniform and overstocked (~400 trees per acre) with minimal understory vegetation, low structural diversity, and intense competition for light, water, and nutrients.

Warmer winters add to these forest health challenges, as more precipitation falls as rain rather than snow, and what snow does accumulate melts earlier in the year. Recognizing the issues posed by a shifting climate—warmer, drier summers and winters—NCF saw an urgent need to test techniques that could restore some of the ecological functions lost under conventional dense-stand management. To address these concerns, NCF and NNRG developed and tested a number of treatments.

Treatments

Thinning

NNRG conducted a commercial thinning of 118 acres that removed the least dominant trees at varying thinning intensities (variable density thinning from below). The thinning spreads available soil moisture and nutrients

among fewer trees, increasing the likelihood that each will have enough water to thrive through the warmer and drier summers ahead.

Thinning intensity	PRE-thinning average trees per acre (TPA)	Percentage of trees removed	POST-thinning average trees per acre (TPA)
Standard	~400	50%	200
Medium	~400	60%	160
Heavy	~400	70%	120



**NORTHWEST
NATURAL
RESOURCE
GROUP**

Snow Gaps

Near the thinnings, NNRG installed 19 snow gaps (0.5- to 1- acre patch cuts in the forest canopy). These allow snow to accumulate on the ground instead of being intercepted by tree crowns, where it would evaporate or melt more quickly. The shade and shelter from the wind in these gaps also extends the spring snowmelt season, providing a time-release of snow melt that can infuse the soil with moisture and feed headwater streams later into the year.

Planting

The gaps were then replanted with a mixture of local seed sources and seedlings from warmer, drier regions of Washington and Oregon. These included Douglas-fir, western redcedar, western white pine, and western hemlock (5,000 seedlings, tagged to identify their seed provenance for long-term monitoring). The intent is to establish a local source of climate-adapted genetic material that could help sustain forest health in the decades to come.



An aerial view of snow gaps at NCF

Results

Thinning and Snow Gaps

Technicians collected data every other week throughout the winter, and every week during the ablation (snowmelt) period after March.

The results showed that significantly more snow accumulated in the gaps, and there was more snow in the thinned forest than the control. The snow in the gaps and thinning areas also lasted longer in spring – on average when the snow in the control forest had fully melted, the gap still had about 50 cm of snowpack and the thinned areas still had some snow.

The snowpack in thinned areas was highly variable, as thinning led to variable canopy cover. Areas where there was a clear view through the canopy accumulated snow almost like a gap, but little snow accumulated directly under tree canopies.



Taking snow depth measurements



**NORTHWEST
NATURAL
RESOURCE
GROUP**

Stretching out the snowmelt later into the spring could reduce the impacts of summer drought on trees and increase the supply of cool water to streams. If thinning provides some of the benefits that gaps do, it could be practical to obtain increased snowpack by thinning dense forest stands, rather than creating fully cleared gaps – a win for both adaptation and mitigation.

Planting

The planting component of the project produced more mixed results. Because the area is snow-covered until June in most years, winter planting is not possible. NNRG planted the first few gaps in June after snowmelt, and had surprisingly decent survival (~80%) given the lack of rainfall afterwards. The remaining gaps were planted in the fall with trees that had been “heeled-in” over the summer. Those trees had very poor survival—either due to the heeling-in process or immediate snowfall after planting—and were replanted with additional seedlings in June of 2024. We tagged a subset of seedlings with their provenance, which will allow us to track survival rates for each of the provenances in each gap to discern any differences in the seedlings' success.



Seedlings planted in a snow gap

COSTS/REVENUE

The following numbers combine both the harvest in the gap cuts and the commercial thinning done between 2021 and 2023.

Volume harvested: 1,426 MBF (thousand board feet)

Gross from sale: \$814,000

Logging & hauling: \$552,000 (\$387/MBF)

Harvest admin (NNRG): \$76,000

Community Forest net: \$186,000

Community Forest net per acre: \$1,600 (\$130/MBF)



**NORTHWEST NATURAL
RESOURCE GROUP**

LEADERS IN ECOLOGICAL FORESTRY

This material is based upon work supported by USDA/NIFA under Award Number 2023-70027-40445.



National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE