

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



Case study:
Post-fire sugar
pine reforestation
in southwestern Oregon

Management goals | Long-term retention of sugar pine on the landscape; comparison of performance of four seed sources from different source climates

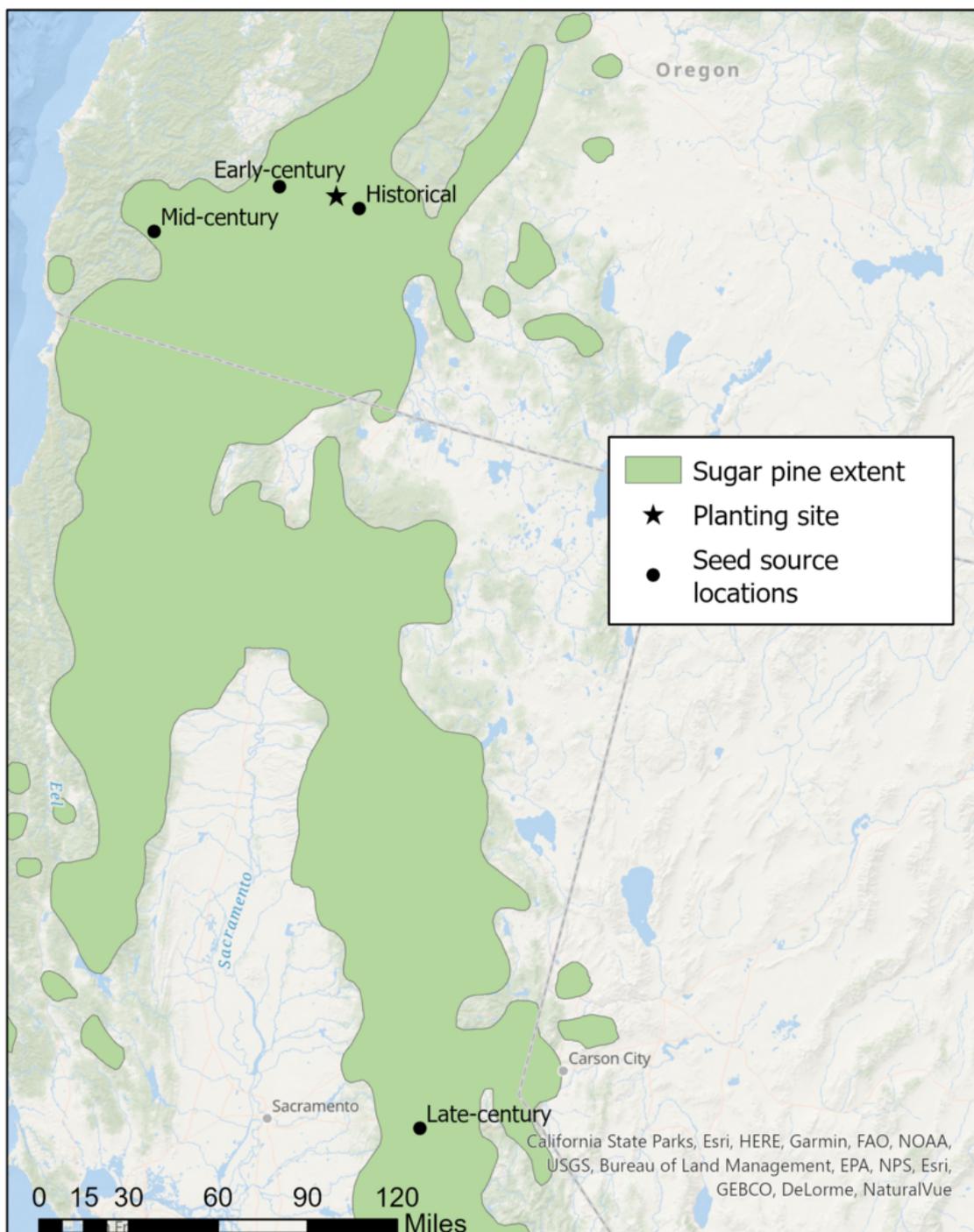
Audience | Forest managers and silviculturists

Project lead | Scott Kolpak, US Forest Service Pacific Northwest Region SW Oregon Area Geneticist

Project area | Umpqua National Forest, southwestern Oregon

Organization | US Forest Service National Forest System Pacific Northwest Region

Funding sources | Internal funds



Planting site on the Umpqua National Forest and sugar pine seed source locations for seed adapted to the site's historical (1961-1990), early-century (2011-2040), mid-century (2041-2070), and late-century (2071-2100) climate conditions.

Site Context

The planting was conducted within the burn scar of the Columbus Fire, which burned over 11,000 acres on the Tiller Ranger District of the Umpqua National Forest during the summer of 2018. The fire burned with mixed severity, with at least 10% of area in high severity patches. These high severity patches included legacy stands of sugar pine (*Pinus lambertiana*), an important species for development of complex structure and wildlife habitat in mixed conifer forests. Sugar pine is susceptible to several threats including white pine blister rust, several bark beetle species and increased fire severity resulting from a legacy of fire suppression. Therefore, long-term retention of the species is a key goal within its range and represents the primary value for the site. Additionally, this site was planted as a research site, with the objective of comparing the performance of four sugar pine seed sources over at least 15 years. Prior to selection as a research area, the site was planned for an operational planting of approximately 80% Douglas-fir (*Pseudotsuga menziesii*) with minor components of sugar pine and ponderosa pine (*Pinus ponderosa*), as sugar pine rarely grows in pure stands.



Tree planter with seedling from one of four sugar pine seed sources. Photo credit: Scott Kolpak

Implementation

The four planted seed sources were chosen using the Seedlot Selection Tool. They were selected to reflect the historical local climate (1961-1990), and future projected climates under the RCP 8.5 scenario for early (2011-2040), mid (2041-2070), and late-century (2071-2100), respectively. The seedlots were assumed to be adapted to their respective historical local climate (1961-1990) and the selection was constrained by species range, an option that can be selected within the tool. The climate variables used were the defaults in the tool, mean cold month temperature (MCMT) and summer heat-moisture index (SHM). Historical, early-century and late-century seed sources were collected from National Forest System Pacific Northwest Region seed orchards using genetic stock bred for white pine blister rust resistance at the Dorena Genetic Resource Center and grown at the Pacific Northwest Region J. Herbert Stone Nursery. The late century seed source was sourced and grown at the Placerville Nursery in the Pacific Southwest Region.

Table 1. Characteristics of the sugar pine seed sources selected for planting.

Seed source elevation	Seed Origin	Climate Period	Change in Mean Cold Month Temperature (MCMT) (°C)	Change in Summer Heat Moisture Index (SHM)
2500' - 4000'	Local seed source	historical/local (MCMT=1.2 °C SHM = 81.9) (1961 - 1990)	NA	NA
<2500'	Local seeds from lower elevation on Umpqua National Forest	early-century (2011 - 2040)	+1.3	+20.7
2500' - 4000'	Siskiyou National Forest -60 mi SW of planting site	mid-century (2041 - 2070)	+2.4	+37.3
2500' - 3000'	Eldorado National Forest -300 mi S of planting site	late-century (2071 - 2100)	+3.9	+50.8

The planting site is a 20-acre block situated on a flat ridgetop at 4000 feet elevation. The planting was intended to reflect typical operational practices in terms of planting time, density, and site preparation. Seedlings were planted at 200 trees per acre with five 1-acre blocks of each seed source. There was no site preparation prior to planting, so seedlings were planted interspersed with slash and other regenerating vegetation. The site was planted on April 27, 2022. Although this is later in the calendar year than initially planned, planting occurred immediately following snow melt, as is typical for operational planting. Funding for this project came from internal funding from the National Forest System Pacific Northwest Region.



Post-fire sugar pine stand before seedlings were planted. Photo credit: Scott Kolpak

Challenges and Opportunities

Several challenges arose during the establishment of this site. The initial site selected on the North Umpqua Ranger District experienced a rain on snow event in January 2022, leading to landslides that washed out access to the site just months prior to planting. The site that was eventually planted on the Tiller Ranger District is ~25 miles south of the initial site. For most species, moving a site this distance would have delayed the project for several years, as the seed sources needed to represent those adapted to the historical, early-, mid-, and late-century climate would have been different. Fortunately, sugar pine has much larger seed zones than many other conifer species in the northwest, and the selected seed sources grown for the original site were still climatically appropriate for the new site.

The planted site also experienced a late snowfall event in April, which delayed planting. This caused some logistical problems including difficulty retaining a planting crew and challenges to coordinating personnel from the National Forest System Pacific Northwest Region to oversee that the planting was done according to the experimental design. However, the extra time prior to planting also resulted in an unexpected benefit. Initially, the planting only included three seed sources, as seed sources adapted to the late century climate scenario are not present in the Pacific Northwest Region. The planting delay provided time to locate seedlings representing the late century seed source from Placerville Nursery in the Pacific Southwest Region. Inter-regional collaboration is outside of the normal process for sourcing seedlings in the National Forest System. Compared with identifying seed sources from within the region, additional time was needed to establish contact and to locate surplus seedlings not needed in operational reforestation in the region for which they were grown, and also fit within the Seedlot Selection Tool output.

Future Plans

Future plans for the site include periodic monitoring to track and compare seedling survival, growth and white pine blister rust among seed sources. Initial measurements are planned in the first-year post-planting, with follow-up measurements at 5, 10, and 15 years post-planting. Visual inspection in the months after planting suggests that initial seedling mortality will be high, though the cause of this mortality is currently unclear. The site is also planned as a demonstration plot for visual comparison of seed source performance through site visits by managers. Application of a release treatment to control competition from hardwoods is being considered as a management intervention. However, there are challenges with implementation of release treatments on Forest Service land, so details of this treatment have yet to be determined.