Opportunities and Challenges to Planting a Sugar Pine Assisted Migration Seed Source Study in Southwest Oregon

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Background

Given the recent increase in wildfire activity and current and projected changes in climate throughout the western US, there is a need to promote forest resiliency by planting trees adapted to current and future climates. Similar to forest managers utilizing species mixes to hedge against future climate uncertainty by adding more drought adapted tree species, such as pines, oaks, and incense-cedar to the historic species mix, within species assisted migration is one tool to help forests adapt to future climates. In this planting strategy, managers match the predicted future climate of a planting site with an off-site population (seed sources) currently growing and adapted to that climate.

In order to determine how this practice bears out on the landscape, field testing of these materials in seed source or assisted migration trials is needed to provide rigorous seed transfer guidelines. As we've seen in recent years, extreme events can have lasting impacts and it might take decades for deleterious climate mis-matches to show up. For instance, rare and irregular extreme weather events like extended subzero temperatures, late spring cold spells, and perhaps heat-domes are important drivers of adaptation.

Tiller Sugar Pine Assisted Migration Seed Source Study Design

Researchers used the Seedlot Selection Tool to identify four seed sources of sugar pine *(Pinus lambertiana)* that were climatically matched to current and future climates, and were blister-rust resistant. Each seed source was planted in five 1-acre blocks on April 27th, 2022 (Table 1, Figure 1). The 20-acre planting sits on a flat ridgetop at 4000' on Umpqua NFs, Tiller Ranger District (Figure 2). The north-facing site experienced a high-severity burn in the 2018 Columbus Fire.

TABLE 1: *Seed sources used in the Umpqua's Sugar Pine Assisted Migration Seed Source Study*

Seed Source	Elevation	Seed Origin	Climate period	Change in MCMT* (°C)
10044	2500'-4000'	Local seed source (control)	historic/local (MCMT=1.4 °C)	NA
10043	<2500'	Local seeds from lower elevation	early-century	+1.5
11054	2500'-4000'	Siskiyou National Forest—SE of experimental site	mid-century	+2.5
526	2500'-3000'	Eldorado National Forest—S of experimental site	late-century	+4.5

**Mean Coldest Month Temperature*

A planting crew member tucks sugar pine seedlings into the experimental planting site in the scar of the 2018 Columbus Fire. Photo Credit: Scott Kolpak

Challenges and Opportunities

Tree planting activities are always dynamic, with the need to make adjustments depending on changing weather and site conditions, and coordinating these with contract planters. The sugar pine AM trial had its share of challenges. After coordinating with North Umpqua District Silviculturists to complete site visits and a draft site layout, a warm weather rain event in January atop new snowfall produced multiple landslides that required us to move our site south to the Tiller Ranger District. Luckily, the large seed deployment zones of sugar pine (compared to Douglas-fir and Ponderosa Pine) permitted the climatically matching seed sources for the North Umpqua site to also be a good fit for the Tiller site. This was a relief because the seedlots had been growing in bareroot beds at the nursery for about 2 years. After picking among a couple possible sites on the Tiller RD, we rapidly completed a GIS layout of the planting blocks, and began the physical layout… walking amongst the burnt timber to install stakes at the block corners, and flagging the block boundaries to match the intended seed source color code.

Again, mother nature dropped 12-18 inches of snow on the experimental site during an unexpected early April storm. This proved to be an advantageous delay; it gave us time to locate surplus trees from the USFS R5 Nursery at Placerville, CA. The Eldorado NF seedlot gives us the opportunity to examine the effects of a blister rust resistant late-century seed source. A new District Planner was able to deliver five boxes of Eldorado trees to Tiller's tree cooler as he made his journey from his old position near Lake Tahoe.

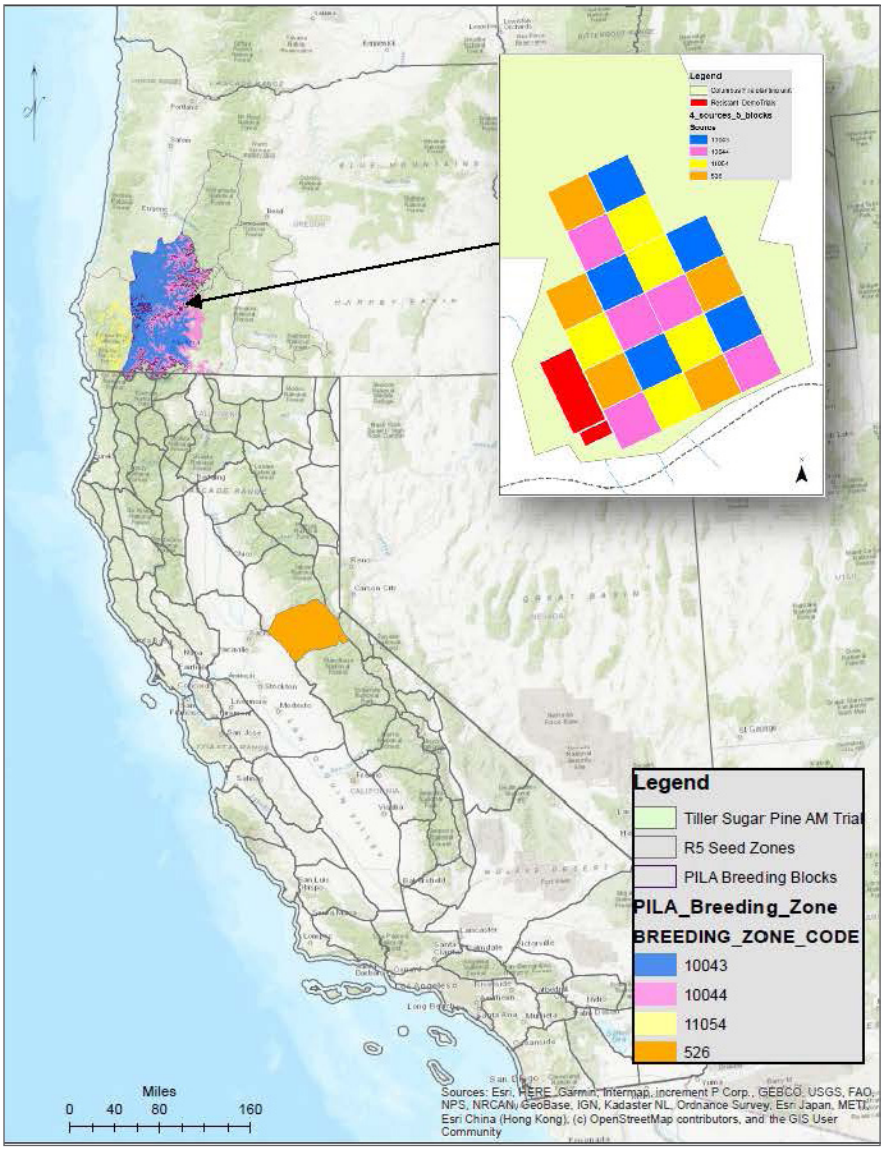

Figure 1: Context map and block design. Graphic created by Scott Kolpak

Future Plans

We will continue to monitor the site by establishing ¼ acre measuring plots so that we can track the relative growth and survival of the seed sources for a minimum of 15 years. In addition, the small neighboring visual demonstration plot will allow forest managers to compare the performance of seed sources planted in adjacent rows. The USFS's Dorena Genetic Resource Center is installing a blister rust resistance monitoring plot in upcoming years to help track the influence of disease on these seed sources. Data collection and analysis will be completed in coordination with USFS Geneticists, and PNW and PSW Station researchers and technicians through a new Washington Office Award, "The right seed in the right place: Assessing and achieving desired post-fire restoration outcomes in California, Oregon, and Washington." This program aims to work with local landowners to install a network of 20 – 30 assisted migration and advanced silviculture trials across the western US. We look forward to evaluating the results of this and other trials as we determine how, when and where to adapt forest management practices to climate change.