Using Historical Provenance Test Data to Understand Tree Responses to a Changing Climate in Sugar Pine (*Pinus lambertiana*)

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Climate change is a major concern for forest managers involved in ecological restoration, in part because they are responsible for planting trees that will be components of a healthy and resilient ecosystem for the next 100 to 200 years. Anticipated changes in climate include changes in temperature, precipitation, and length of the growing season. Trees locally adapted to their native climate may not be able to survive or grow in novel climates. Current afforestation strategies may thus require the use of seeds from populations already adapted to future climates.

Researchers can help to identify these populations thanks to provenance tests. Provenance tests are studies where genotypes from different sources (or provenances), coming from the entire range of the species or only a subset, are transplanted onto a common site. In fact, individuals are moved from one climate, are planted in a new one, and can be monitored for survival and growth. Therefore, this experimental design is ideal for understanding how trees respond to novel climates.

In this study we will focus on two sets of sugar pine (*Pinus lambertiana*) provenance tests. The first involves four test sites, two in California (USA) and two in Oregon (USA). Sixty-nine sources, spanning the entire range of this species from Mexico to Oregon, were planted in each of the four sites starting in 1984. The second test, Harrel, has only one planting site; 124 sources of sugar pine were planted on that site in 1992. Using information on where the seeds were collected, we can generate data for a set of climate variables (monthly average, minimum, and maximum temperatures; and monthly total precipitation) using available models.

The aim of our study will be to assess whether the growth and survival of the trees in the transplanted site is influenced by the climate at the home site. Our hypothesis is that trees are better adapted to the climate at the home site and thus, the growth and survival of transplanted trees will be negatively affected by a strong difference in climate between the home and the transplanted sites.

In: Schoettle, Anna W.; Sniezko, Richard A.; Kliejunas, John T., eds. 2018. Proceedings of the IUFRO joint conference: Genetics of five-needle pines, rusts of forest trees, and Strobusphere; 2014 June 15–20; Fort Collins, CO. Proc. RMRS-P-76. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 245 p.