

Early Results From a Newly-Established Provenance Test in Valley Oak (*Quercus lobata*) Show Significant Population Differentiation¹

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Valley oak (*Quercus lobata*) is a majestic, endemic California native oak, found throughout California's foothills, valleys and flood plains. It is threatened because:

- Contracted range due to housing and agriculture.
- Low recruitment in existing stands as a function of land use and increased stress on existing trees and recruitment due to recent and projected climate change.

Valley oak substantially shapes ecosystem functions and biodiversity where it occurs through above ground (e.g., provides shelter with cavities, and food with acorns) and below ground (e.g., soil stability and productivity) contributions. Valley oak is also important to California's diverse Native American cultures, including the location of historic trade routes and settlements. To create a resource for research, education and conservation, in 2015, we established a fully-replicated two-site provenance trial from a range-wide acorn collection, representing 674 uniquely identified maternal trees from 95 populations of valley oak from across California now growing at the U.S. Department of Agriculture Forest Service's Institute of Forest Genetics in Placerville, California, and the Chico Seed Orchard in Chico, California. Provenance tests, such as the one described here, are powerful research tools, allowing for the comparison of trees from a diverse range of climates in common garden settings. By comparing growth and performance in two climatically different gardens, we are able to understand more about the underlying genetics of traits.

While the trees were growing in the greenhouse, and during the first 2 years after the provenance trial was established, we measured growth and phenology at both sites. We found genetic correlations among a variety of leaf, growth, and phenological traits expressed across families. Many of the observed differences are associated with climatic conditions where the seeds were collected. For example, trees from warmer sites (higher mean annual temperature) were taller. Although results are preliminary given the short time span since outplanting, cluster analysis based on data collected so far shows groups of populations that are beginning to show similar trends for growth and phenology.

This provenance trial represents a major scientific and conservation resource for valley oak as a species and a community as they face multiple environmental challenges. Furthermore, we are in the process of sequencing the valley oak genome, which will allow us to integrate phenotypic and genomic data to identify the genes underlying adaptive traits. Together with the data collected from the provenance test, we will be able to address questions like seed transfer distances as well as identifying populations of conservation concern, information that will further advance our potential to inform the conservation of this iconic species.

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