

HOW CAN OAKS SURVIVE AND THRIVE IN FUTURE CLIMATES?

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Oaks (*Quercus*) are an amazingly resilient genus of trees. They evolved approximately 60 million years ago in the Paleoarctic. As the planet cooled, they spread southward and diversified throughout the Northern Hemisphere into almost 500 species, and dominate ecosystems where they occur. One secret to their success is large effective population sizes that maintain genetic variation allowing them to adapt to new environments. A second secret is their ability to hybridize and exchange genes resulting in adaptive introgression. However, humans are now exposing oak species to unprecedented rates of climate warming. Provenance studies already indicate that many populations show signs of maladaptation to current temperatures. In this talk, I will explore ways that genomics can provide tools to help oaks persist in future climates. First, I will discuss how landscape genomics, which associate genetic gradients with climate gradients across a region or species range, can identify populations that are particularly vulnerable to climate warming. Second, I will review the concept and benefits of assisted gene flow, which is the active transport of genotypes into existing populations. Third, I will describe existing and potential genomic methods that can identify genotypes that would enhance tree response to warmer climates. Such methods could be used for the management of existing oak populations vulnerable to climate warming and the restoration of populations destroyed by prior deforestation or recent fires. Oaks have been a resilient genus throughout their evolutionary history. Active intervention may allow some species to survive and eventually thrive in future climates.

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