USGS Western Ecological Research Center
Publication Brief

Landscape Genomics: A Tool for Guiding Native Plant Restoration

Plant populations are often adapted to local environmental and climate conditions. This poses challenges for managers searching for the best seed sources to re-vegetate areas ravaged by large disturbances like wildfire. For example, managers face the question of how far seeds of a particular plant species can survive outside their home environment. Fortunately, a new approach called "landscape genomics" can aid in mapping the genetic differences between plants across a landscape.

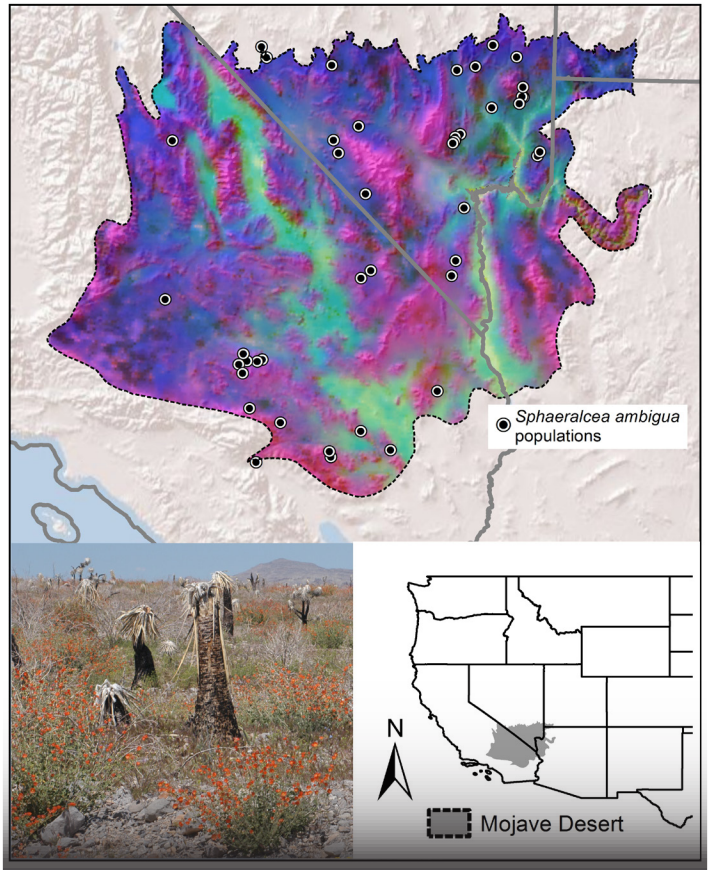
Researchers from the USGS Western Ecological Research Center, USGS Southwest Biological Science Center, and University of Colorado, Boulder used a landscape genomics analysis to inform managers on seed sourcing for desert globemallow (*Sphaeralcea ambigua*), a perennial subshrub native to the Mojave Desert. This species is important for restoring degraded desert landscapes, in part due to its role as forage and cover for the federally Threatened Mojave desert tortoise (*Gopherus agassizii*).

The research team collected green leaf tissue from 47 globemallow populations spanning the Mojave Desert and extracted genomic DNA from 446 individuals. The DNA were analyzed for signals of natural selection in response to important environmental drivers. GIS maps were created from the DNA results to depict patterns of local adaptation of globemallow populations across the Mojave Desert. The results are published in *Conservation Genetics*.

Shryock et al. reveal that summer maximum temperature, temperature differences between summer and winter, and a satellite-derived measure of aridity are the strongest drivers of local adaptation in globemallow populations. Moreover, GIS maps of the scale and direction of local adaptation across the landscape can guide managers to areas where seeds can be collected and used to improve restoration success. These maps also identify which plant populations can be combined to diversify restoration seed mixtures and help combat the negative effects of climate change.

Research is currently underway to develop landscape genomic models for multiple Mojave Desert plant species and identify the specific plant traits that respond to temperature and aridity gradients through common garden experiments.

This Brief Refers To:
Shryock, DF, CA Havrilla, LA DeFalco, TC Esque, NA Custer, TE Wood. 2015. **Landscape genomics of *Sphaeralcea ambigua* in the Mojave Desert: a multivariate, spatially-explicit approach to guide ecological restoration.** *Conservation Genetics* 16:1303-1317. doi:10.1007/s10592-015-0741-1



Map illustrating the pattern of local adaptation in *Sphaeralcea ambigua* (orange-flowered shrub, bottom left). Similar colors indicate areas predicted to have similar locally-adapted genotypes. *Shryock et al.* 2015

MANAGEMENT IMPLICATIONS

- Populations of *Sphaeralcea ambigua*, a shrub important to desert tortoises, are locally adapted to environmental variables like maximum temperatures and aridity.
- GIS maps derived from landscape genomic models correlate locally-adapted genotypes with environmental features and can inform restoration strategies.
- Landscape genomic models can identify populations with genomic adaptations best suited to projected conditions under warming scenarios.

RESEARCH CONTACT

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