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Identifying Evolutionary Hotspots and Gaps in Land Protection in the Mojave and Sonoran Deserts

In light of increased questions on wildlife conservation and energy developments in the U.S. Southwest, USGS has been conducting landscape genetics research in the Mojave Desert to identify regions of conservation importance.

A study in *Diversity and Distributions* by USGS researchers profiles the use of genetic data and GIS to identify hotspots of genetic divergence and diversity — areas that may ensure evolutionary resilience of animal populations — and to assess whether protected lands overlapped with these evolutionary hotspots.

Researchers analyzed spatial and temporal variations in previously published DNA sequence data for 12 species of reptiles, amphibians, small mammals and spiders found across the Mojave and Sonoran Deserts. Distinct lineages were identified and dated within species, and researchers also tested for a signature of population expansion within lineages and dated expansion.

For all species assessed, six hotspots of high genetic divergence and diversity were concentrated along the Colorado River and across the Mojave and the Sonoran Desert ecotone. At least some proportion of the land within each recovered hotspot was categorized as protected, yet four of the six also overlapped with major areas of human development.

Lineage dating suggests that many species diversified prior to the “Last Glacial Maximum” — suggesting that many species have persisted despite long-term environmental change. In addition, distinctive Mojave and Sonoran lineages were recovered in most species studied, suggesting that protection throughout both of these ecoregions is warranted.

Management Implications

- Landscape genetics analysis and hotspot mapping can help identify areas for protection in Mojave and Sonoran Deserts.
- At least some proportion of the land within each determined hotspot was categorized as protected, yet four of the six hotspots also overlapped with major areas of human development.
- Protected areas that encompass evolutionary hotspots can help wildlife species retain genetic diversity, ensure population connectedness across the landscape, and ultimately, help increase long-term resilience of species against environmental and man-made change.

THIS BRIEF REFERS TO:

Wood, DA, AG Vandergast, KR Barr, RD Inman, TC Esque, KE Nussear, RN Fisher. 2012. Comparative phylogeography reveals deep lineages and regional evolutionary hotspots in the Mojave and Sonoran Deserts. *Diversity and Distributions*. doi: 10.1111/ddi.12022

<http://www.werc.usgs.gov/ProductDetails.aspx?ID=4842>
<http://www.werc.usgs.gov/vandergast>



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Researchers analyzed 12 desert species, including small burrowing species like the shovel-nosed snake (*Chionactis occipitalis*), to map out the evolutionary hotspots.