USDA
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Rocky Mountain Research Station

Science You Can Use *(in 5 minutes)*

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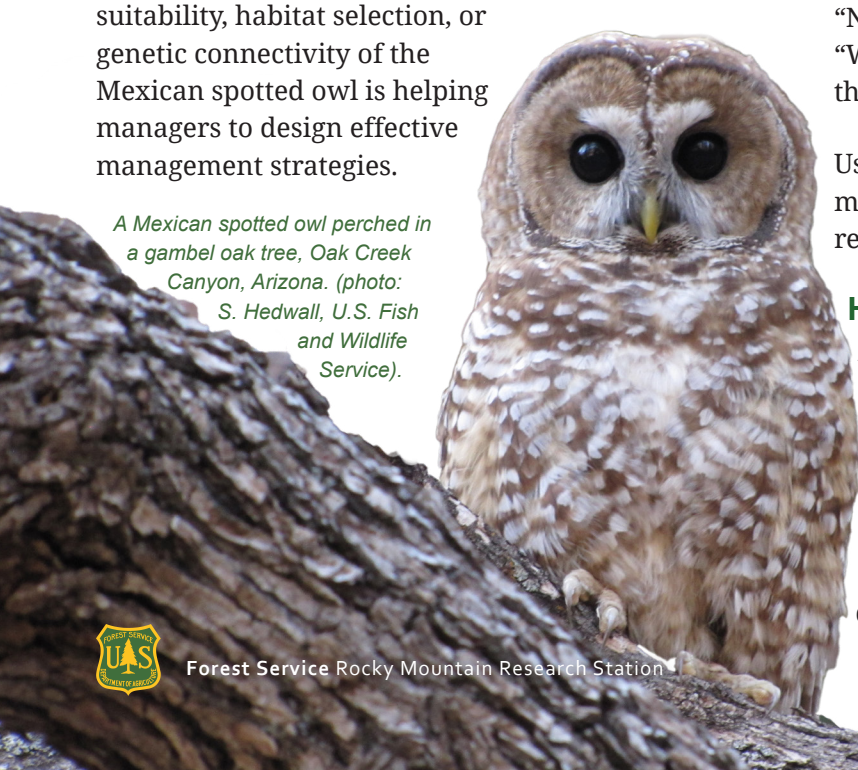
Location, location, location. Scale, scale, scale: Mexican spotted owl habitat

Designing effective conservation strategies for the Mexican spotted owl in the context of increasing threats driven by climate change requires understanding complex relationships among multiple environmental factors—factors that can vary across space and time.

"Reliable predictions about a particular phenomenon, for example selecting nesting sites, or food resources within an individual's home range, requires observing the system at the right scale—in both space and time, and the right location" says Sam Cushman, Research Landscape Ecologist with the Rocky Mountain Research Station.

Cushman and his colleagues rely on modeling to help untangle the layers of complexity among these relationships in order to gain insights about the Mexican spotted owl that would be impossible to obtain otherwise. Their research on habitat suitability, habitat selection, or genetic connectivity of the Mexican spotted owl is helping managers to design effective management strategies.



A Mexican spotted owl perched in a gambel oak tree, Oak Creek Canyon, Arizona. (photo: S. Hedwall, U.S. Fish and Wildlife Service).

Habitat suitability

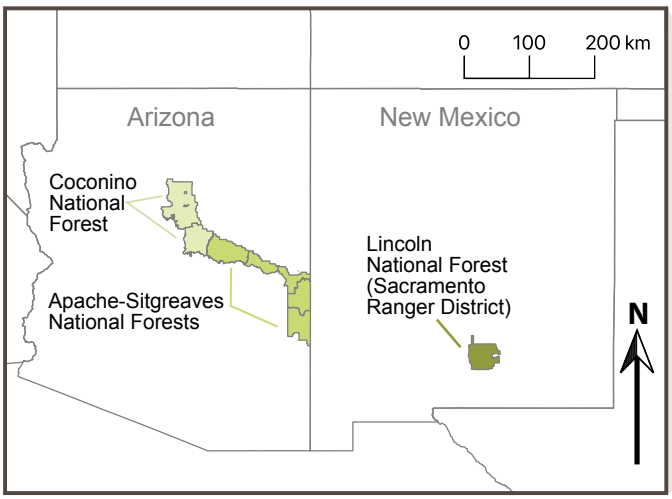
A model designed to predict whether one area has the resources owls need for a given activity may not work well in another region. That's because conditions vary across the landscape. Cushman and his colleagues confirmed this idea when they compared predictions of habitat suitability for the Mexican spotted owl in the Mogollon Plateau in Arizona using three different models. Although all three models identified the White Mountains region of the Mogollon Rim as a core area of important habitat for the owl, and the local model generally performed best in the portion of the study area where it was developed, the hybrid model performed best across the entire study area. For Karl Malcolm, who, until recently was the southwest region's wildlife ecologist with the Forest Service, this research drives home the value not only of modeling research, but of understanding variation across landscapes.

"Not all spotted owl habitat is created equally," he says. "What you're looking for in Arizona might be different than what you're looking for in Southern New Mexico."

Using the appropriate modeling tools can save managers time and effort and help them design restoration efforts that are best suited for a given area.

Habitat selection

Another study modeled how factors that vary across space and time—such as topography or forest structure and composition—influence habitat selection (e.g. where owls choose to nest and why). Using habitat selection models that take into account multiple scales and location specific information, Cushman and his colleagues detected important differences in habitat selection between two regions.



Locations of USDA Forest Service Mexican spotted owl study sites are shown in green on the map at left.

features impede the flow of genes in an area, Cushman and his colleagues compared gene flow in areas of high and low fragmentation using resistance models. While the models predicted that larger patches of habitat provide a safe haven for genetic variation, how those patches are configured and the degree of continuity may be more important for gene flow. Incorporating habitat configuration into management plans could benefit recovery efforts.

In the Sacramento Mountains, percent cover of mixed-conifer forest was key for Mexican spotted owl occurrence, whereas topography was more important in the Mogollon Plateau. The study also indicated the habitat alone didn't always account for distribution patterns. In the Sacramento Mountains, territoriality and competition for resources likely contributed to the pattern of spacing between owl sites.

Genetic diversity

To help visualize spatial patterns of genetic connectivity and to understand which landscape

KEY MANAGEMENT CONSIDERATIONS

- Mexican spotted owl habitat varies by geographic location. In the Sacramento Mountains, percent cover of mixed-conifer forest was strongly associated with the likelihood of Mexican spotted owl occurrence, whereas topography was key in the Mogollon Plateau.
- Larger patches of habitat provide a genetic refuge for the Mexican spotted owl but the degree of continuity or fragmentation may be more important in promoting gene flow.
- To conserve genetic diversity, management plans may benefit from incorporating habitat configuration recommendations that facilitate gene flow.
- Because habitat varies across the landscape, a model designed to predict whether an area has the resources owls need for a given activity may not work well in another region. Appropriate modeling tools can save managers time and effort in designing restoration efforts for a given area.

PROJECT LEAD

Sam Cushman is a research landscape ecologist at the Rocky Mountain Research Station in Flagstaff, AZ. Connect with Sam at https://www.fs.usda.gov/rmrs/people/scushman

FURTHER READING

Timm, Brad C.; McGarigal, Kevin; Cushman, Samuel A.; Ganey, Joseph L. 2016. Multi-scale Mexican spotted owl (*Strix occidentalis lucida*) nest/roost habitat selection in Arizona and a comparison with single-scale modeling results. Landscape Ecology. doi: 10.1007/s10980-016-0371-0.

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Wan, Ho Yi; Cushman, Samuel A.; Ganey, Joseph L. 2018. Habitat fragmentation reduces genetic diversity and connectivity of the Mexican spotted owl: A simulation study using empirical resistance models. Genes. 9: 403.

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