

TITLE:

How and why roads make the endemic Dunes Sagebrush Lizard (*Sceloporus arenicolus*) disappear

Abstract

Why does landscape fragmentation cause population decline? The answer depends on species' life history and behavioral constraints, its ecological role, and its dependence on specific landscape features. Meticulous ecological studies on the endemic habitat specialist, Dunes Sagebrush Lizard (*Sceloporus arenicolus*), reveal mechanisms of population scaling from locally interacting individuals up to the distribution of the species across its range. Dunes Sagebrush Lizards live in "neighborhoods". Larger neighborhoods produce excess recruits that disperse and diffuse across the interconnected landscape. Neighborhood size is correlated with landscape configuration; irregular-shaped (edgy), poor-quality habitats support smaller neighborhoods, where recruitment does not balance mortality. Diffusion-dispersal from large thriving neighborhoods maintains smaller neighborhoods and thus insures population persistence at a regional scale. The Mescalero-Monahans shinnery dune ecosystem, where these lizards and other endemics exist, overlies the Permian Basin, a region beset with extensive fragmentation from oil and gas roads. Fragmentation from these roads disrupts both the geomorphologic processes that maintain dunes and the dispersal dynamics that connect lizard neighborhoods. Our research has also shown that these lizards do not cross roads. Conservation measures in place for the Dunes Sagebrush Lizard call for localized habitat protection. However, the extent of these measures does not match ecological scaling in this system and may not protect the shinnery dunes from the higher level problem of fragmentation that drives species disappearance. Mismatch between conservation scaling and ecological scaling is a pervasive challenge to achieving biodiversity conservation. Nevertheless, insights from this case study drive home the importance of conservation research that informs the development of policies that match the ecological scaling of target species.