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Publication Brief for Resource Managers

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Loss of Genetic Connectivity and Diversity in Urban Microreserves in a Southern California Endemic Jerusalem Cricket

Microreserves (fragments of open space of less than a square kilometer) may be useful in protecting native arthropod diversity in urbanized landscapes. However, species that do not disperse through the urban matrix may be lost from these fragments over time. Local extinctions may be precipitated by an increase in genetic differentiation among fragments and loss of genetic diversity within fragments, and these effects are expected to become stronger with time. USGS scientists Amy Vandergast, Robert Fisher, Eric Lewallen and Joe Deas, and collaborators from San Diego State University and the California Academy of Sciences analyzed population genetic structure in a dispersal-limited Jerusalem cricket to determine the impacts of recent fragmentation and isolation in microreserves in the Simi Hills, north Los Angeles, California. Their work has been published online recently in the *Journal of Insect Conservation*.

Management Implications:

- In a flightless insect, greater levels of genetic divergence were associated with urban fragmentation and older fragments, suggesting that urban fragmentation can disrupt natural levels of population connectivity and that these effects become stronger with time.
- Although differences in abundance were not measurable, populations in urban microreserves contained significantly less genetic diversity than those in larger reserves.
- To maintain arthropod diversity in urban microreserves over long periods of time, conservation efforts should focus on restoring habitat connectivity among these fragments.

The Jerusalem cricket *Stenopelmatus* n. sp. "santa monica" is distinguished from other co-occurring species based on a combination of morphological differences, mating calls and number of chromosomes. Adults can reach weights up to 11 grams. Photo by D. B. Weissman, California Academy of Sciences.

The researchers examined mitochondrial DNA (MtDNA) sequences and anonymous nuclear markers in populations of the Jerusalem cricket *Stenopelmatus* n. sp. "santa monica." They compared genetic structure among fragments of various sizes surrounded by urban development in the Simi Hills to that of populations in more contiguous natural areas in the adjacent Santa Monica Mountains. This framework was used to determine whether major highways and other urban development are associated with higher levels of genetic divergence, whether genetic divergence is correlated with temporal patterns of development, and whether genetic diversity is associated with fragment size or age.

The researchers found slightly different patterns of divergence in the different genetic markers examined. Sequences from genes located in mitochondria (cellular

organelles that contain their own genetic material) were more divergent among urban fragments than within contiguous habitat, and divergence was positively correlated with fragment age. MtDNA genetic diversity within fragments increased with fragment size and decreased with fragment age. Genetic divergence across 38 ISSR loci (inter-simple sequence repeats found throughout the nuclear genome) was influenced by the presence of major highways and highway age, but there was no effect of additional urban fragmentation. ISSR diversity was not correlated with fragment size or age. Differing results between these markers may be influenced by intrinsic differences in the genes examined (different effective population sizes, sorting rates, or mutation rates), and/or male-biased dispersal. Together, results suggest that genetic connectivity among populations has been disrupted to some extent by highways and urban development, prior to noticeable declines in abundance (based on pitfall trapping efforts). Additionally, microreserves contained less genetic diversity than larger fragments and populations in contiguous habitat. This study emphasizes that genetic connectivity can rapidly erode in fragmented landscapes and that arthropods can serve as sensitive indicators for these effects.

Vandergast, A. G., E. A. Lewallen, J. Deas, A. J. Bohonak, D. B. Weissman, and R. N. Fisher. 2008. Loss of genetic connectivity and diversity in urban microreserves in a southern California endemic Jerusalem cricket (Orthoptera: Stenopelmatidae: Stenopelmatus *"santa monica"). Journal of Insect Conservation DOI 10.1007/s10841-008-9176-2*.

[Note: This journal article will also appear in a future print issue of *Journal of Insect Conservation.*]