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Western Ecological Research Center

Publication Brief for Resource Managers

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Potential Effects of Atmospheric Nitrogen Deposition on Alien Annual Plants in the Mojave Desert

Deserts are one of the least invaded ecosystems, possibly due to naturally low levels of soil nitrogen. Increased levels of soil nitrogen caused by atmospheric nitrogen deposition may increase the dominance of invasive alien plants and decrease the diversity of plant communities in desert regions, as it has in other ecosystems. Deserts may be particularly susceptible to these changes, because even small nitrogen deposition rates translate in to relatively large percent increases in available soil nitrogen. In a test of these hypotheses, USGS scientist Dr. Matt Brooks evaluated the effects of increased soil nitrogen on alien and native annual plants in the Mojave Desert of southwestern North America.

Nitrogen was applied to replicate 0.2 m^2 experimental plots in the central, southern, and western Mojave Desert at rates similar to those measured in urban areas adjacent to the Mojave Desert (3.2 g/m^2). Soil nitrogen addition increased the density and biomass of alien annual plants during two years of contrasting rainfall and overall annual plant productivity, suggesting that the benefits of nitrogen deposition to alien annuals may be significant during years of high or low rainfall. During the year of high annual plant productivity, nitrogen addition led to decreased diversity and abundance of native species, possibly due to increased competitive stress for soil water and other nutrients that was caused by the increased biomass of aliens.

These results indicate that increased levels of soil nitrogen from atmospheric nitrogen deposition, or from other sources, could increase the dominance of alien annual plants and possibly promote the invasion of new species into desert regions. Increased dominance by alien annuals could decrease the diversity of native annual plant communities, and increased fine-fuel loads created by alien annual grasses may increase the frequency and size of wildland fires.

Management Implications:

- Desert regions subjected to high nitrogen deposition rates may be more easily invaded and dominated by alien annual plants.
- Although nitrogen deposition cannot be directly controlled by local land managers, they need to understand how it may interact with land use activities and potentially benefit alien plants.
- The effects of nitrogen deposition on invasive alien plants should be considered when deciding where to locate new conservation areas, and in evaluating the full scope of ecological effects of new land use projects that would increase nitrogen deposition rates.

Brooks, M. L. 2003. Effects of Increased Soil Nitrogen on the Dominance of Alien Annual Plants in the Mojave Desert. Journal of Applied Ecology 40:344-353.