7-19-1999

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ECOLOGICAL IMPACTS OF POGONOMYRMEX ON WOODY VEGETATION OF A LARREA-AMBROSIA SHRUBLAND

Simon A. Lei

A BSTRACT.—Plant species richness, density, and frequency were quantitatively examined within Pogonomyrmex rugosus (seed-harvester ant) nest discs and at various distances from nest discs in a Larrea tridentata—Ambrosia dumosa (creosote bush—white bursage) shrubland in southern Nevada. Woody vegetation at and near the edge (perimeter) of nest discs showed decreased species richness, density, and frequency compared with vegetation in adjacent reference areas (nestest; 4 m beyond discs). Four of 17 species were found with significantly lower density and frequency on nest discs than at greater distances from the nest. Thirteen of 17 species were not found on nest discs at all. Species richness, density, and frequency were significantly and negatively correlated with distance from nests. Woody vegetation was sparse and less variable in composition when occurring at discs and edges of discs. Local disturbances caused by P. rugosus nests may largely alter immediate surrounding vegetation in the L. tridentata—A. dumosa shrubland of southern Nevada.

Key words: Pogonomyrmex rugosus, woody vegetation, nest, colony, disc, edge, Larrea tridentata, Ambrosia dumosa, southern Nevada.

Pogonomyrmex rugosus (seed-harvester ant) occurs in arid and semiarid plant communities throughout much of southwestern United States (Carlson and Whitford 1991). Previous studies have shown that ant activities can change vegetation patterns and composition (Beattie and Culver 1977, Culver and Beattie 1983, Hobbs 1985, Rissing 1986, 1988, Carlson and Whitford 1991). Nests of Pogonomyrmex species are generally clear of plants at least in the central area surrounding the single nest entrance where ant activities are most intense (Beattie and Culver 1977). Because ant colonies are usually overdispersed, associated vegetation appears to be patchy and variable in composition (Beattie and Culver 1977). Most mounds in the Mojave Desert of southern Nevada and in the Sonoran Desert of central Arizona often have been cleared completely or almost completely of vegetation by the ants (Rissing 1986, 1988). Similarly, other studies have found changes in plant diversity and composition (Beattie and Culver 1977, Culver and Beattie 1983), population densities (Hobbs 1985), and vegetation production (Rogers and Lavigne 1974) associated with ant nests. A study in New Mexico (Carlson and Whitford 1991) has shown that Pogonomyrmex species also may alter vegetation by soil modification, destruction of plants, seed dispersal, and/or seed predation.

Larrea tridentata—Ambrosia dumosa (creosote bush—white bursage) is a dominant vegetation type in southern Nevada, and yet ecological impacts of P. rugosus on this vegetation type are not fully understood. This article explores ecological impacts of P. rugosus nests on plant species richness, density, and frequency by analyzing woody vegetation at varying distances from colonies in the L. tridentata—A. dumosa shrubland in southern Nevada.

METHODS

Study Site

Field studies were conducted in L. tridentata—A. dumosa shrubland in Henderson, near Las Vegas, Nevada (roughly 36°00'N, 115°00'W; elevation 750 m), during spring 1997. Vegetation is composed predominantly of L. tridentata and A. dumosa with scattered distribution of other woody taxa, including Krameria parvifolia (ratany), Ephedra nevadensis (Nevada

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Pogonomyrmex rugosus had local effects on immediate surrounding vegetation in the L. tridentata-A. dumosa shrubland. Density of P. rugosus reached 23.3 colonies per hectare. Seventeen woody plant species were found in this study. Species richness declined significantly ($P < 0.001$; Fig. 1) when approaching P. rugosus colonies. Bare ground was observed at the center and disc perimeter of most P. rugosus nests. Four of 17 woody species were found at significantly lower density and frequency on nest discs than at greater distances from ant nests (Tables 1, 2). Larrea tridentata showed highest density and frequency among all woody taxa on nest discs (Tables 1, 2). However, 13 of 17 species did not exist at all on nest discs (Tables 1, 2). Opuntia aenothocarpa (buckhorn cholla), O. basilaris (beavertail), O. echinocarpa (silver cholla), and O. ramosissima (pencil cholla) occurred $\geq 21$ m from P. rugosus nests (Table 1).

Significant negative correlations were detected between species richness and distance from P. rugosus nests (Tables 1, 2, Fig. 1). Species richness declined significantly ($P < 0.001$) when approaching P. rugosus colonies. The mean species richness of woody vegetation sampled in 0.5-m² quadrats within P. rugosus nest discs and at various distances from discs in the L. tridentata-A. dumosa shrubland ($n = 349$). Narrow vertical bars represent standard errors, and different letters at column tops indicate significant differences at $P \leq 0.05$.
from *P. rugosus* nests ($r = -0.49, P \leq 0.001$), between species density and distance from nests ($r = -0.58, P \leq 0.001$), and between species frequency and distance from nests ($r = -0.68, P \leq 0.001$). Flora within and around disc perimeters was relatively homogeneous (Table 1). On the contrary, flora in adjacent reference areas was significantly more diverse ($P \leq 0.001$; Table 1).

### DISCUSSION

*Pogonomyrmex rugosus* locally influences plants beyond denuded areas as evidenced by decreased species richness, density, and frequency, as well as altered vegetation composition adjacent to discs. Nest discs were generally clear of plants, and local disturbances caused by *P. rugosus* appear to increase vegetation...
homogeneity, especially within discs and around disc perimeters, in the *L. tridentata–A. dumosa* shrubland. Clark and Comanor (1975) state that the majority of harvester ant species in the genus *Pogonomyrmex* may actively defoliate leaves and destroy plants growing on and near their nests to reduce shade because high nest temperatures are required for brood development.

Species diversity, as well as density, and frequency of some species between disc and edge quadrats and between edge quadrats and 1-cm from edge quadrats were not significantly different. The disc is a visually obvious nest structure, but not the limits of the nest itself, which may extend below the soil surface at a distance beyond the disc. Furthermore, the *P. rugosus* colony influences soil surface beyond the limits or physical structure of the nest disc as well. Perhaps the edge is an interface between the distinct zones of the nest disc and beyond it.

The presence of *P. rugosus* has potential to alter soil properties and to determine germination and reproductive success of woody species, which may ultimately change the successional progression of *L. tridentata–A. dumosa* shrublands. Further investigations are required to examine how patterns of colony abandonment and reestablishment affect a large percentage of the area and influence patterns of soil development and plant community succession through time in southern Nevada.

**ACKNOWLEDGMENTS**

I gratefully acknowledge Steven Lei, David Valenzuela, and Shevaun Valenzuela for helping to collect vegetation data in the field. David Charlet critically reviewed the manuscript and provided helpful comments.

**LITERATURE CITED**


Received 21 August 1998
Accepted 7 December 1998