Effects of Urban Land-Use Type on Ground-Arthropod Communities

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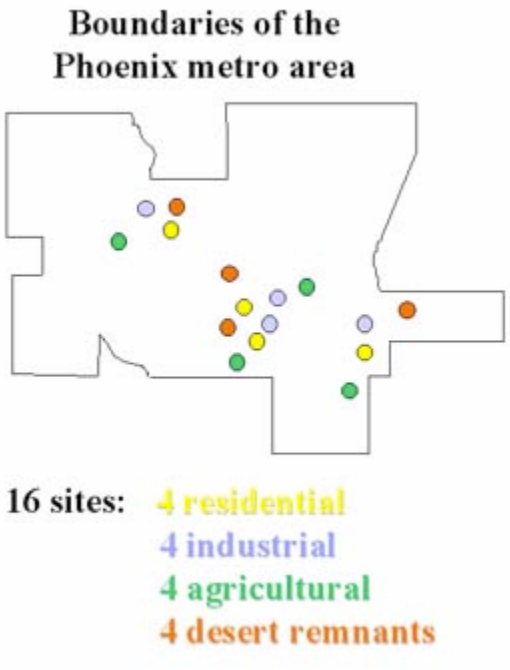
"So important are insects and other land-dwelling arthropods that if all were to disappear, humanity probably could not last more than a few months. Most of the amphibians, reptiles, birds, and mammals would crash to extinction about the same time. Next would go the bulk of the flowering plants...As dead vegetation piled up and dried out, closing the channels of the nutrient cycles, other complex forms of vegetation would die off...The land would return to approximately its condition in early Paleozoic times...largely devoid of animal life."

E.O. Wilson, *The Diversity of Life* (W.W. Norton & Co., Inc, New York, 1992).

Introduction

In the long-term monitoring tradition of LTER research, we are providing insights about an ecologically important group of organisms: urban arthropods. We are systematically surveying arthropods in a variety of urban and suburban habitats. Results from this survey will enable us to determine how the abundance and distribution of this diverse group of organisms are affected by habitat type, habitat area, and habitat context within the urban landscape. As urban development is expected to continue into the foreseeable future, such baseline information is crucial in assessing the impact of urbanization.



Why study arthropods?

- because they are so abundant and diverse they provide a snapshot of overall biodiversity
- because short generation times means they

respond quickly to changes in land-use
- because they represent a spectrum of trophic levels
- because they are relatively easy to sample (vis à vis vertebrates)
- because they are ecologically, economically, and sociologically important

Objectives

- to provide baseline information on arthropod richness and abundance in the Phoenix metropolitan area
- to compare arthropod diversity in different urban land-use types
- to predict patterns of arthropod diversity in future locations of urban development

Methods

Sites within 4 geographic regions of the Phoenix metropolitan area (NW, NC, SC, E) (Fig. 1):
- 4 types of urban land-use
- agricultural fields (4 sites)
- desert remnants (4 sites)
- residential xeriscaped yards (4 sites)
- industrial properties (4 sites)

Methods (Fig. 2): pitfall-trapping
- 10-21 traps per site
- traps opened for 3 d/mo, 4/98-present
- all arthropods collected, identified, and counted

Data (Fig. 3): diversity & abundance
- total number of taxa
- total number of individuals
- relative abundance of each taxon
- trophic status of each taxon

Initial Results

The same average number of arthropod taxa were found in the 4 types of land use, although more individuals were captured at the industrial sites (Fig. 4). There were no differences among the 4 geographic regions of the metro area where trapping was done.

However, taxonomic composition differed among land-use types (Fig. 5).

Most of the arthropods captured were <2mm in total body length (e.g. mites, springtails, Fig. 5).

Figure 1. Map showing the locations of the 16 sites where arthropods are being collected.

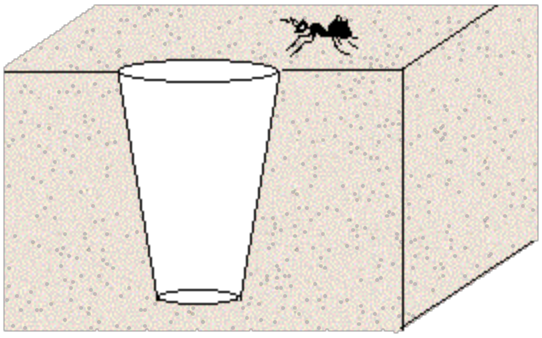


Figure 2. Cross-section of a pitfall trap, the sampling technique used in this study. A pitfall trap consists of a cup set into the ground into which walking arthropods fall.

Figure 3. Marc Hinze and Sean Walker collect arthropod samples in the field.

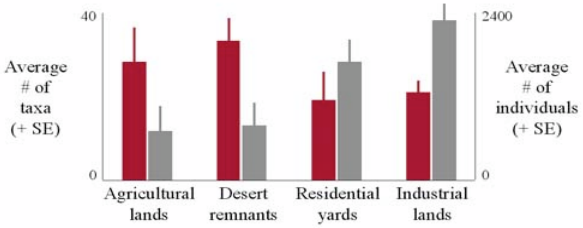


Figure 4. Average number of arthropod taxa (burgundy bars, left-hand Y-axis) and individuals (gray bars, right-hand Y-axis) caught in each of the 4 types of urban land use, standardized across sites by trapping area. (Click on figure to see enlarged.)

Predators (e.g. spiders) and herbivores (e.g. true bugs) were most abundant in the agricultural sites, whereas scavengers (e.g. ants) were most abundant in desert-remnant and industrial sites, and detritivores (e.g. springtails) were found primarily in residential areas (Fig. 5).

Implications

- the presence of agricultural fields within the metro area boosts the overall arthropod diversity of the region
- residential xeriscaped yards are not good mimics of desert habitats with respect to arthropod community structure

Future Plans

- measure habitat variables (vegetation, soils) at each site
- sample taxa other than ground arthropods
- include more sites and types of land use to capture more of the region's biotic variability

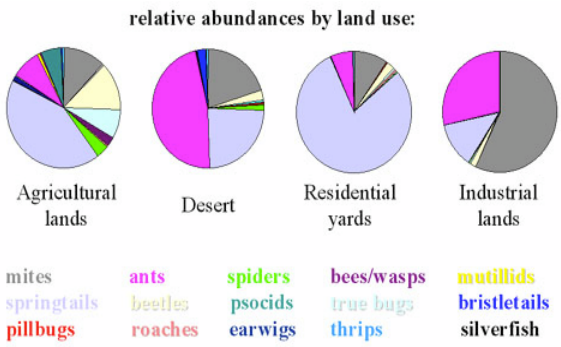


Figure 5. Pie charts showing the taxonomic composition of the arthropod community in each of the 4 types of urban land use. (Click on figure to see enlarged).