Land management and household characteristics mediate species assemblages in residential landscapes

Riley Andrade[1], Kelli L. Larson[1, 2], Janet Franklin[3], and Christopher Swan[4]

[1]School of Geographical Sciences and Urban Planning, Arizona State University; [2]School of Sustainability, Arizona State University; [3]Department of Botany and Plant Sciences, University of California, Riverside; [4]The Department of Geography and Environmental Systems, University of Maryland, Baltimore County

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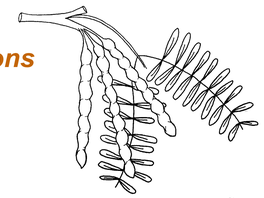
Overview

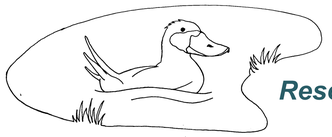
Urban ecosystems are underrepresented in community ecology

Ecological communities in cities are assembled through processes such as **intra/interspecific interactions, dispersal, resource dynamics,** and **interactions with people**

Species Interactions



Dispersal



Resource Dynamics- Env Filtering

People affect community composition

DIRECTLY- moving and removing species (facilitated dispersal)

INDIRECTLY- through the landscape mosaic management decisions that influence patch composition and configuration

Household and individual structure are related to yard management decisions

These characteristics tend to be spatially clustered

The question remains whether the effects of spatial and environmental processes driving community composition vary throughout a city due to human activity

Research Questions

1. How do environmental versus spatial processes influence ecological community structure?
2. Do household characteristics and land management decisions change the relationship between community structure with local and regional processes?

Methods

We integrated data from the Phoenix Area Social Survey, spatial imagery, and the Ecological Survey of Central Arizona to measure the effects of social, environmental, and spatial process on tree, insect, and bird communities in Phoenix, Arizona

Variation in community composition was measured using beta-diversity (defined as the differences between the species pools between sites)

Conceptual Framework

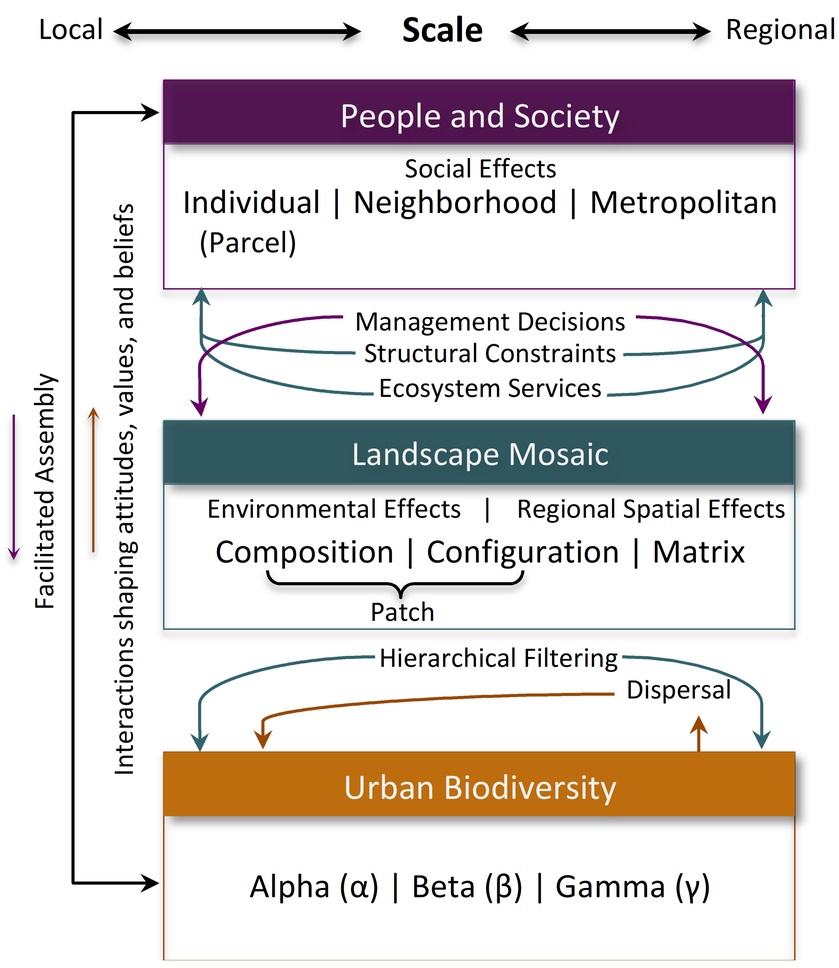


Figure 1. Multiscalar framework connecting people and biodiversity through the urban landscape mosaic (spatial pattern of habitat patches within the urban ecosystem).

Differences in Phoenix Neighborhoods

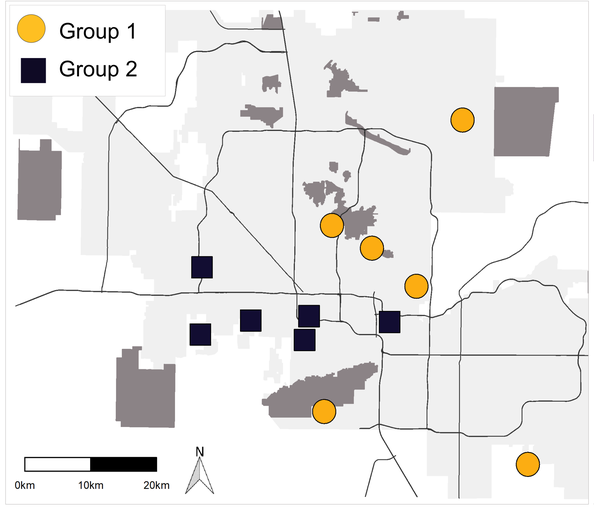


Table 1. Differences in individual and household structure in residential neighborhoods determined by a hierarchical cluster analysis (Ward's D).

Component	Group 1	Group 2
Income	6.5 ± 1.7	3.3 ± 1.0
Education	0.7 ± 0.1	0.3 ± 0.2
Age	57 ± 4	42 ± 4
Mexican/Latino	0.04 ± 0.0	0.53 ± 0.2
% of Life in Phx	0.48 ± 0.1	0.62 ± 0.1
Born in AZ	0.11 ± 0.1	0.31 ± 0.1
Own/Rent	0.81 ± 0.2	0.58 ± 0.3
Decision Maker	3.8 ± 0.4	3.5 ± 0.6
HOA	0.66 ± 0.3	0.53 ± 0.4
Lot Age	32 ± 17	31 ± 22

Results

Table 2. Spatial and environmental components of the urban landscape mosaic used to explain the differences in community composition between (1) all neighborhoods, (2) group 1: high-income neighborhoods, and (3) group 2: low income neighborhoods. Results from significant models and standardized beta value are reported.

Tree Community	All	Group 1	Group 2
Spatial	**R^2= 0.06***	-	-
Patch Distance	-	-	-
Environmental-Local	**R^2= 0.28***	-	**R^2= 0.28**
Productivity	β= 0.41	-	β= 0.34
Ecological Niche	β= 0.25	-	β= 0.33
Environmental- Regional	**R^2= 0.27***	-	**R^2= 0.22**
Disturbance	-	-	-
Patch Configuration	β= 0.46	-	β= 0.51
Insect Community			
Spatial	**R^2= 0.11***	-	-
Patch Distance	β= 0.35	-	-
Environmental-Local	**R^2= 0.19***	-	**R^2= 0.26***
Productivity	β= 0.33	-	-
Ecological Niche	β= 0.23	-	-
Environmental- Regional	**R^2= 0.09***	-	**R^2= 0.30***
Disturbance	β= 0.37	-	β= 0.46
Patch Configuration	-	-	-
Bird Community			
Spatial	**R^2= 0.30***	-	**R^2= 0.25***
Patch Distance	β= 0.55	-	β= 0.54
Environmental-Local	**R^2= 0.42***	**R^2= 0.27***	**R^2= 0.46***
Productivity	-	-	-
Ecological Niche	β= 0.56	β= 0.62	β= 0.74
Environmental- Regional	**R^2= 0.61***	-	**R^2= 0.57***
Disturbance	β= 0.63	-	β= 0.71
Patch Configuration	β= 0.21	-	-

Conclusions

Spatial Effects

Spatial effects were more important for active dispersing bird communities compared to insects or trees.

Environmental Filtering

Environmental heterogeneity at both the local and regional scales was associated with differences between tree and insect communities in low socioeconomic neighborhoods.

Individual and Household Structure

Insect and tree communities in high-income neighborhoods are likely driven by human-environment interactions such as attitudinal values shaping facilitated dispersal.

Bird communities in high-income neighborhoods are primarily driven by local, aspatial patterns in landscape typology.