Rodent diversity and gene flow across urban desert remnants in Phoenix, AZ, USA

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Introduction

Arid cities are predicted to experience greater urban biodiversity losses than other cities due to processes of habitat fragmentation and loss. Rodents are a group of interest in arid cities due to their history of commensalism with humans and high taxonomic diversity. While some urban rodents may maintain genetic connectivity with wild populations, others may become isolated leading to reduced genetic diversity and inbreeding. **Given the many possible outcomes and high diversity of rodents in arid cities, there is a key need to move beyond single-species studies to examine how gene flow dynamics vary among co-occurring species and relative to their differing ecologies.**

Research Questions & Predictions

Question 1: How does urbanization affect rodent diversity across an aridland city?

$H_{1,A}$: As urbanization increases, species diversity will decrease. Some species will be more affected by urbanization than others.

$H_{1,0}$: Rodent diversity has no relationship to urbanization, distance from a natural habitat path, or area of the resident patch.

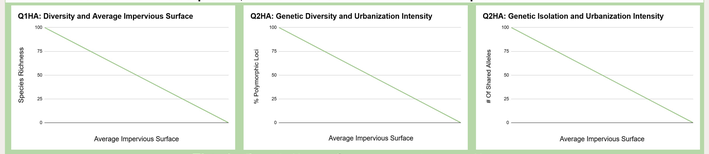


Fig. 1: Predictions for research questions.

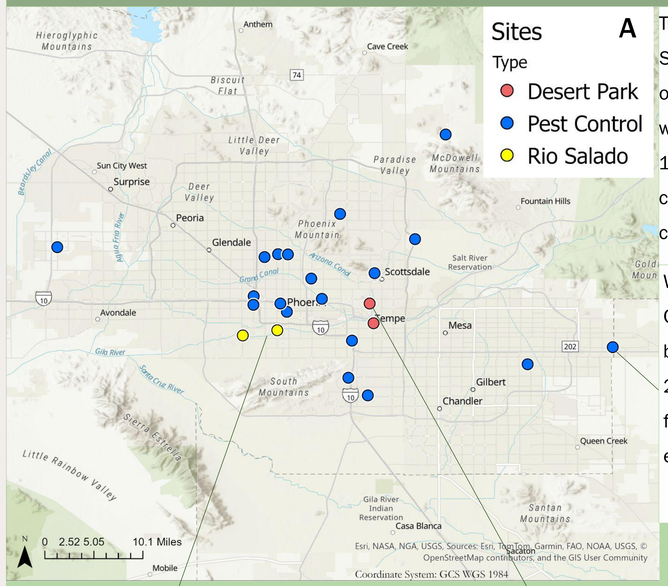
Question 2: How does urbanization affect genetic diversity and connectivity of ecologically different rodent species?

$H_{2,A}$: Some rodent species will experience greater reductions in genetic variability via genetic isolation than others as urbanization increases.

$H_{2,0}$: Gene flow, degree of genetic isolation, and genetic variability have no relationship with the intensity of urbanization across all species.

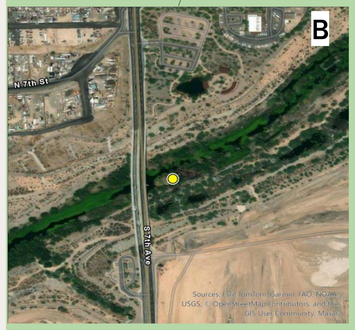
Fig 2: Pictures from fieldwork in May 2024

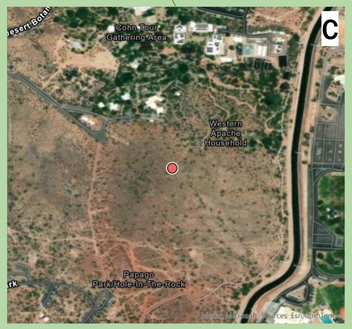
Approach - Site Selection, Methods, Initial Results



Trapping occurred from May - Dec 2024. Sampling sites were selected from a subset of CAP LTER sites to pair small mammal data with active ecological projects. At each site, 150 Sherman folding traps were set over the course of one night. Ear or liver tissue was collected from each animal.

Working in collaboration with Blue Sky Pest Control, roughly 100 samples are expected to be collected from private lands from October 2024 - May 2025. Samples were collected, frozen, and will be processed in our lab to excise ear tissue for DNA sequencing.





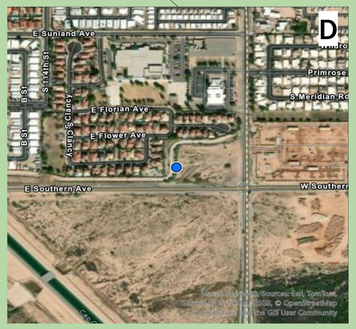


Fig. 3: (A) Map of study area and successfully sampled sites. Blue dots indicate 1-5 individuals were sampled by pest control and coordinates have been altered slightly to maintain customer anonymity. Red and yellow dots represent, respectively, desert park and Rio Salado sites selected from a larger pool of CAP LTER study sites. (B) Satellite image of Rio Salado and 7th Avenue. (C) Satellite image of Desert Botanical Garden, south. (D) Satellite image of a pest control site where a *Neotoma albigula* was collected.

Fig. 4: Species of interest: (A) *Chaetodipus penicillatus*, (B) *Rattus rattus*, (C) *Neotoma albigula* (D) *Dipodomys merriami*

Site Name	Species	Animals/Trapnight	% Imperv. Surface
"A" Mountain (Tempe Butte)			
	Chaetodipus penicillatus	21	52.59%
	Peromyscus eremicus	1	
Total	2	**22**	
Desert Botanical Garden, south			
	Chaetodipus penicillatus	5	38.15%
	Peromyscus eremicus	16	
	Neotoma albigula	3	
Total	3	**24**	
Rio Salado and 7th Ave			
	Chaetodipus penicillatus	2	38.77%
	Peromyscus eremicus	5	
	Neotoma albigula	1	
	Mus musculus	1	
	Rattus rattus	8	
Total	4	**17**	
Rio Salado and 35th Ave			
	Chaetodipus penicillatus	9	52.98%
	Peromyscus eremicus	8	
	Sigmodon arizonae	2	
	Dipodomys merriami	1	
Total	4	**20**	
Pest Control Sites			
	Thomomys bottae	9	14%-68%
	Neotoma albigula	8	
	Mus musculus	2	
	Rattus rattus	1	
Total	4	**20**	
Grand total	8	**103**	

Future Research

- Additional fieldwork at three sites for desert parks and along the Rio Salado corridor during January - May 2025
- Standardize lab protocols for sequencing DNA from liver and ear tissues
- Focus gene flow analyses upon the following widespread species:
  - *Chaetodipus penicillatus, Peromyscus eremicus, Rattus rattus*

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