Building Communities: Insights from Desert Rodents

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Introduction

Logic would predict similar environments possessing communities with similar functional traits to be more similarly structured than those without. However, this is not the case in many communities, including the grainivorous rodent communities of the Mojave and Negev Deserts. In the Mojave, the community structure is driven by predation, while in the Negev, the community structure is driven by resources. But what causes these differences? Here we substitute species in an experimental community to gain insights into what causes these differences in community structures.

Results

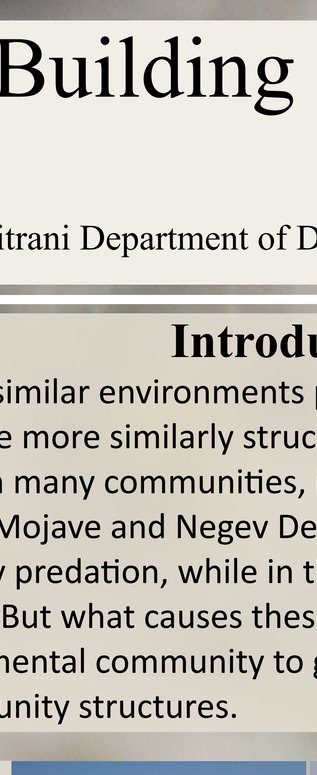
Our results show differences in mechanisms detected between different pairs of rodents. For example, *Gerbillus andersoni allenbyi* appeared to better handle snakes while *Gerbillus pyramidum* could better mitigate the risk of owls and the risk of multiple threats. However, when *G. pyramidum* is paired with *Dipodomys merriami*, *D. merriami* can better mitigate these risks. While we equate much of the ability to handle risk to body size, we also suggest that certain adaptations, such as bipedal locomotion, also play key roles into determining a communities' structure.

Negev Desert

34-310 mm Annual Precipitation

Temperatures 0-40 °C

Resource Driven

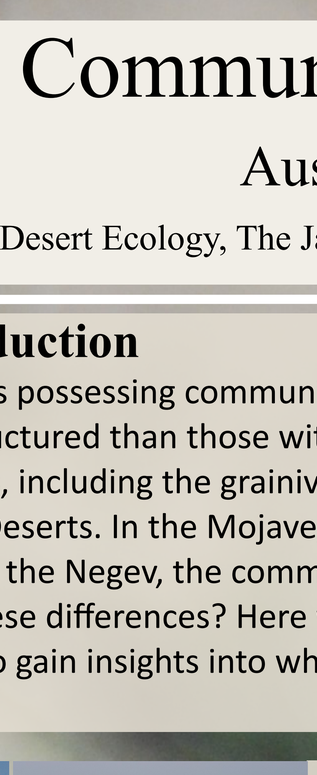


Mojave Desert

34-310 mm Annual Precipitation

Temperatures 0-40 °C

Predator Driven



Gerbillus andersoni allenbyi (Allenby Gerbil)

Mean Mass: 26.2 g

No Cheek Pouches

Quadrupedal

Chaetodipus penicillatus (Desert Pocket Mouse)

Mass: 13-20 g

External Cheek Pouches

Quadrupedal

Gerbillus pyramidum (Greater Egyptian Gerbil)

Mean Mass: 39.9 g

No Cheek Pouches

Quadrupedal

Dipodomys merriami (Merriam's Kangaroo Rat)

Mass: 33-53 g

External Cheek Pouches

Bipedal

Cerastes cerastes (Saharan Horned Viper) [SHV]

Max Length: 80 cm

No Sensory Pits

Crotalus cerastes (Sidewinder Rattlesnake) [SWRS]

Max Length: 61.5 cm

Sensory Pits

Tyto alba (Barn Owl)

Sound localization

Silent flight

Low-light vision

Tyto alba (Barn Owl)

Sound localization

Silent flight

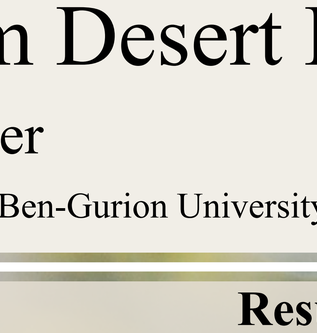
Low-light vision

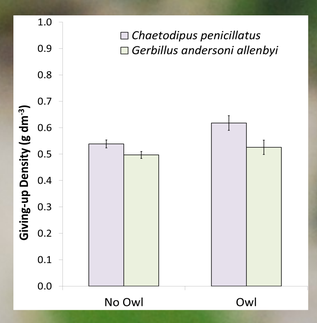
Gerbillus andersoni allenbyi & Gerbillus pyramidum

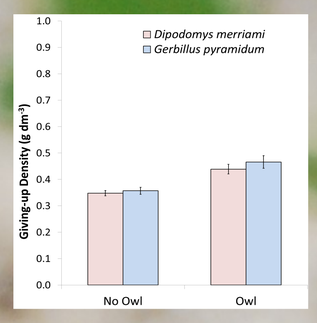
Gerbillus andersoni allenbyi & Chaetodipus penicillatus

Dipodomys merriami & Gerbillus pyramidum

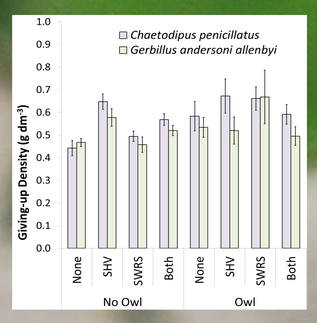
Owl & Species

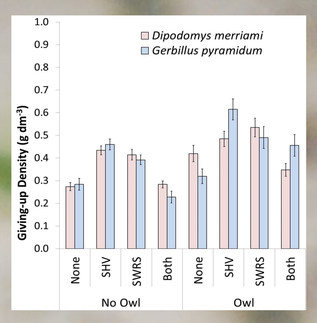




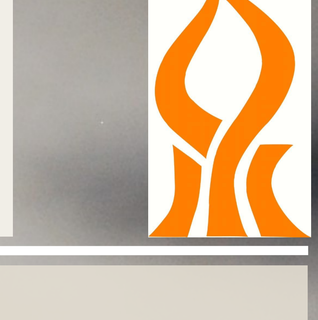


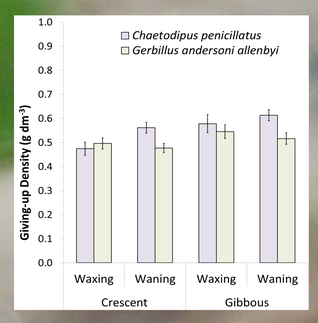
Owl, Snake & Species

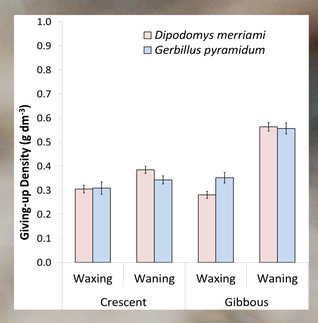




Moon Phase & Species





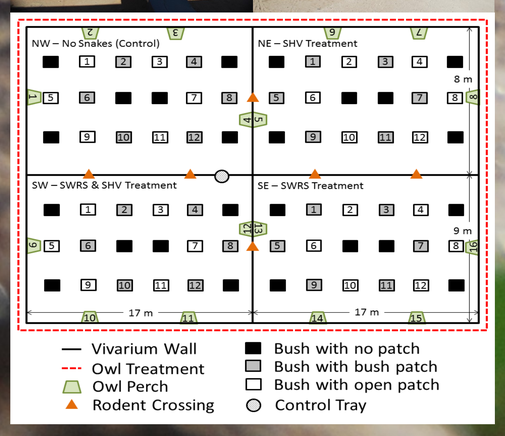


Conclusions

Communities are complex, but through experimental manipulation we can begin to understand how such similar systems can result in vastly different outcomes. Species traits including body size, bipedal locomotion, external cheek pouches, and sensory pits may give their species an edge that breaks the constraints of the communities adaptive landscape resulting in a community operating under different mechanisms of coexistence.

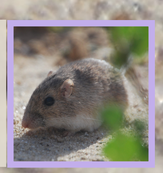
Methods

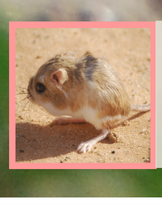
Experimental communities were simulated in a vivarium which allowed rodents to travel between snake treatments. Additionally, an owl would be released during some nights to add another element of risk. During each night of a lunar cycle, rodents foraged seed patches in bush and open microhabitats and their giving up density was collected along with tracks to know who visited the patch.



Gerbillus andersoni allenbyi & Gerbillus pyramidum
Represents a natural community with the exception that these rodents can choose to interact with a novel viper predator, the sidewinder rattlesnake.

Gerbillus andersoni allenbyi & Chaetodipus penicillatus
Simulates a novel community where G. pyramidum is replaced by a small heteromyid. This results in a community with two small rodent species.





Dipodomys merriami & Gerbillus pyramidum
Simulates a novel community where G. andersoni allenbyi is replaced by a large heteromyid. This results in a community with two large rodent species.

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