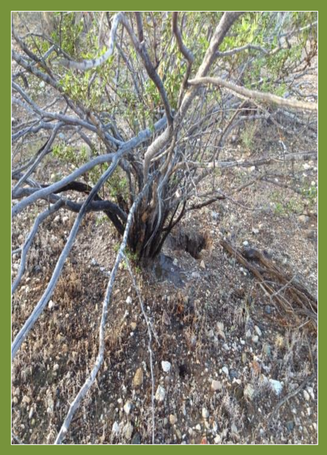

Impacts of Altered Precipitation on Aboveground-Belowground Interactions in the Sonoran Desert

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Introduction:

- Altered precipitation patterns resulting from climate change will have significant consequences in water-limited desert ecosystems.
- While research on the effects of altered precipitation to desert plants is readily available, research on the impacts to the soil community beneath these plants is not.
- Understanding the response of the soil community to altered precipitation regimes is key to understanding implications of climate change for biogeochemical processes in the Sonoran Desert. Soil invertebrates play a crucial role in maintaining the integrity of the soil, providing the necessary elements for the function and success of plant life. As soil properties change, so may the plants, animals, and landscape of the desert.
- It is unknown whether soil invertebrates of the Sonoran Desert will thrive or decline as a result of altered precipitation due to climate change. For this study, we treated the soil under native plant types with different amounts and frequencies of simulated rain. This was performed during the monsoon season of July through September. Soil samples were taken at the beginning and end of the monsoon, and invertebrates were extracted and identified.

Research Questions:

To preliminarily investigate the soil biota's response to altered precipitation, we simulated differing amounts and frequencies of rainfall on the soil beneath two native plant types and an interplant area. We asked:

1. How do the micro-arthropod communities differ in the soil beneath these native aboveground types?
2. Do these invertebrates fluctuate with differing amounts and frequencies of precipitation?

Methods:

This study was done at White Tank Mountain Regional Park. It is a CAP site to the west of the city. The area is dominated by two shrub types, Creosote and Bursage. We chose replicates of the two shrubs and bare soil areas from which we took the soil samples. 36 total soil sites were tagged: 12 *Creosote*, 12 *Bursage*, and 12 inter plant space (bare soil).

Pulse Event Simulation:
- Simulated precipitation was dispensed with garden sprayers
- Circumference around the plant basal area to be watered based : 1.57 m
- Half of the replicates of each plant type received a 5 mm water pulse (simulating average precipitation event size) and half received a 7.5 mm water pulse (simulating a 50% increase in event size).
- Frequency of precipitation: Of those plant types that received a 5 mm pulse, half were watered every four weeks and the other half every two weeks. The same frequency treatment was applied to the plant types receiving a 7.5 mm pulse. This represents the average frequency and the average frequency decreased by 50%.

Sample Collection:
- Scooped 550 g of soil from each site within 21 cm of base of plant (initial collection July, final collection September)
- Preserved 500 g of each sample in 95% ethanol

Sample Analyses:
- Micro arthropod extraction via heptane flotation
- Identification of invertebrates under microscope to the Order level.

How to Catch a Micro-arthropod:

Prior to the study's initial invertebrate extraction, and during the extraction process, we tested different methods and determined which were the most effective:

- Heptane flotation extraction vs. Tullgren Funnel extraction: Our soil is sandy and hot, and therefore does not yield results like other types of soil using the heat-based Tullgren Funnel method. Heptane flotation yielded higher extraction efficiency.
- Flotation apparatus: Utilizing a plunger disturbed less surface area of the heptane layer than did manual filling of the flask, allowing maximum invertebrate extraction. It also reduced the processing time by 13% from 3 hours and 20 minutes per sample to 3 hours.
- More vs. less soil: Once processed, samples containing more soil yielded more invertebrates, demonstrating the importance of timely, but critical viewing under the microscope.

Preliminary Results:

- Initial identification of soil invertebrates show mite-dominated samples.
- The process of extracting and identifying soil invertebrates is a lengthy process. Because their numbers can vary from 100 to 1000 per handful of soil, identification is paramount to understanding their response to altered precipitation.

Next Steps:

As we continue heptane flotation and micro arthropod identification on remaining soil samples, we predict the 50% increase in pulse event size will yield a higher population of soil invertebrates. We predict that frequency of events will not change the population as much as the size of events.

- Process soil samples and compare pre and post monsoon data.
- Improve soil collection methods in order to reduce disturbance of the plant basal area.

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