

Temporal Environmental Surveillance for Valley Fever at a Single Location in The Phoenix Metropolitan Area

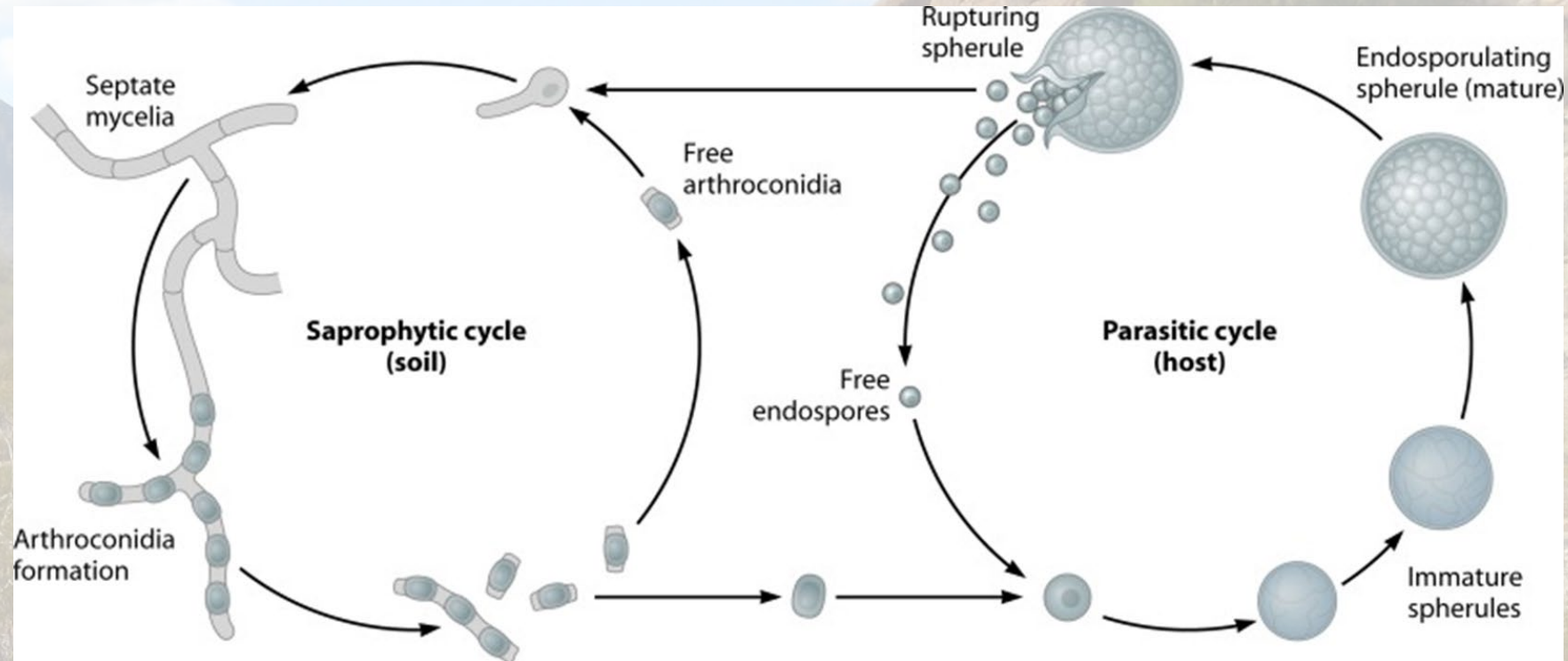
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The Pathogen and Microbiome Institute

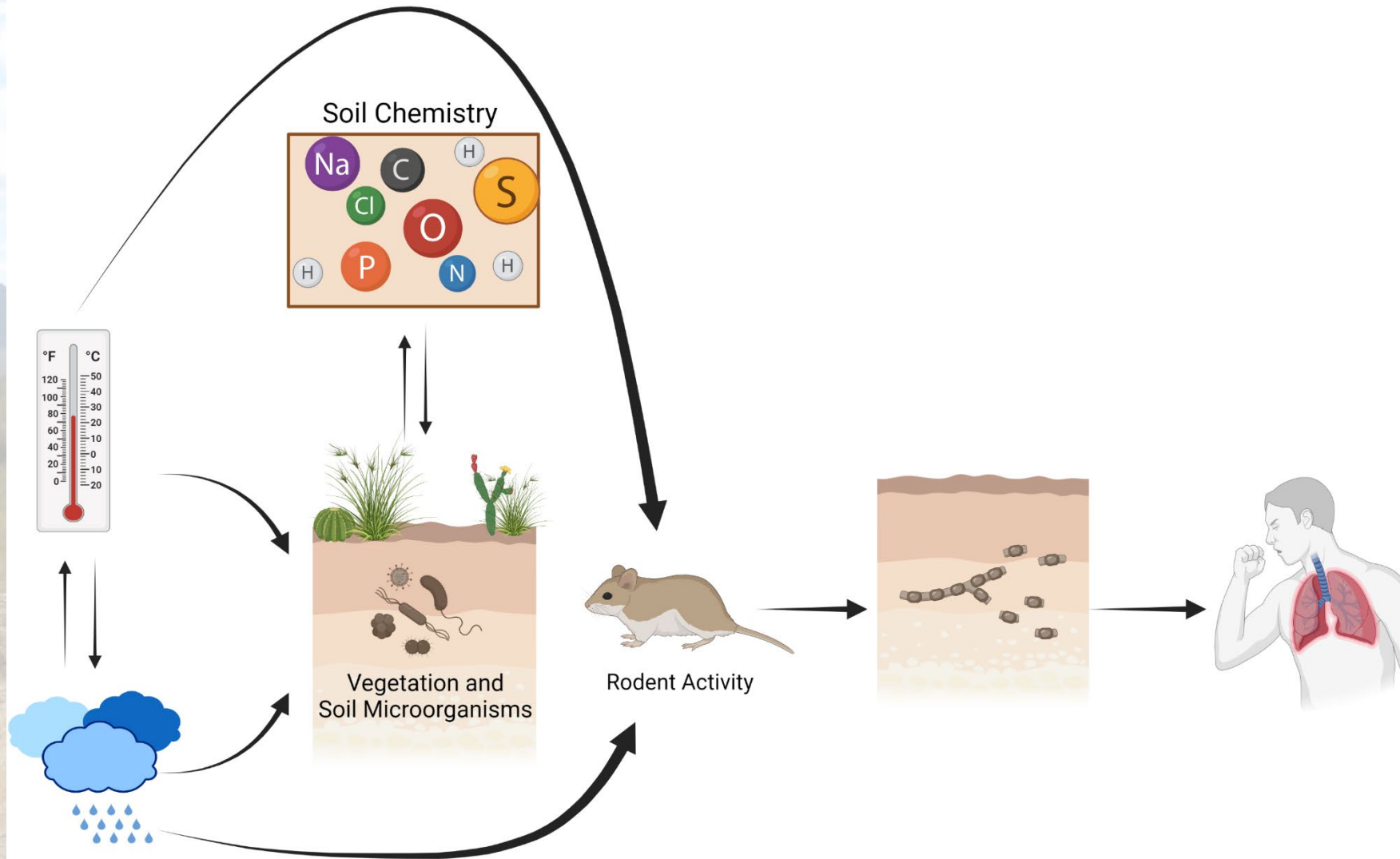
Northern Arizona University

Coccidioides spp. (Valley fever)

- Primary fungal pathogens
- *Coccidioides immitis* and *C. posadasii*
- Soil dwelling in saprobic lifecycle (animal burrows)
- Environmentally acquired infection ****
- Distribution and ecology not well understood



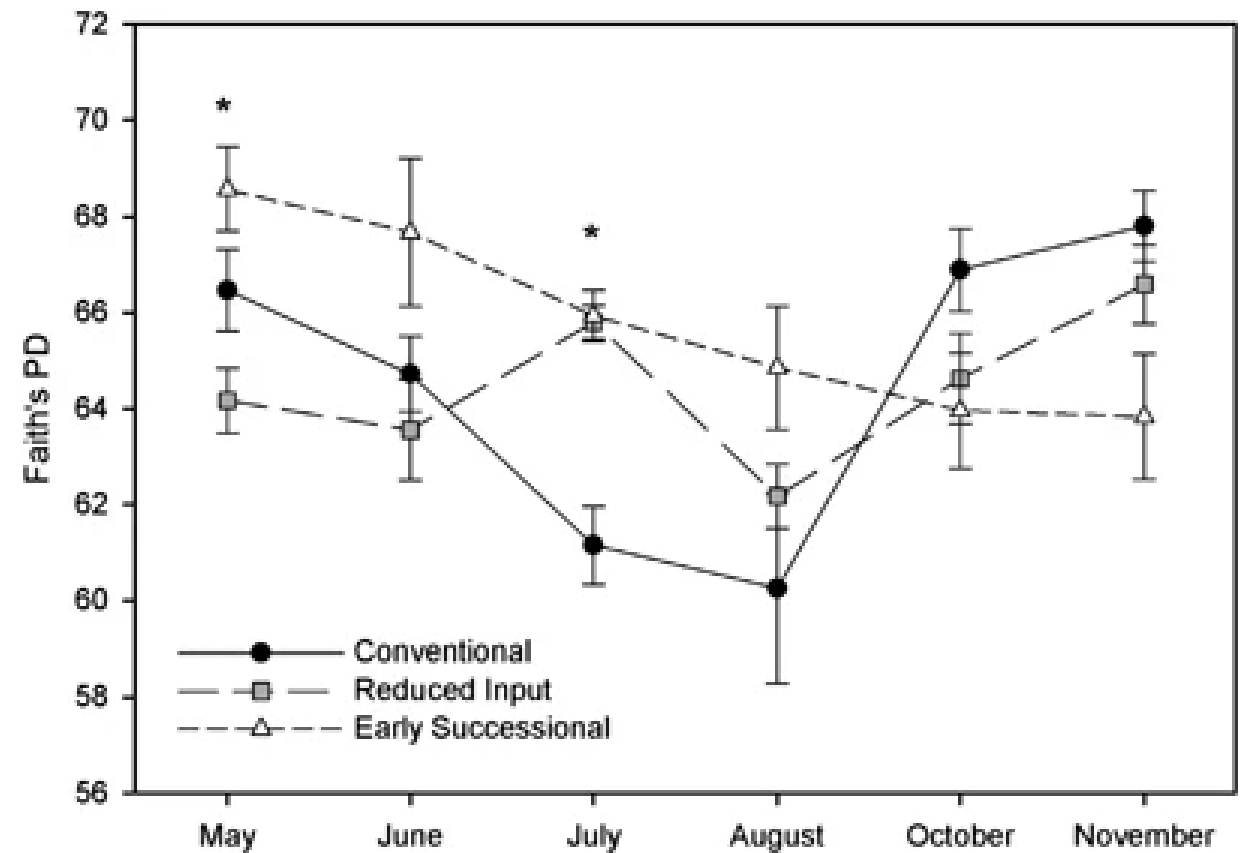
Ecology matters



Fluctuates through time

Traditional environmental sampling

- Soil sampling
- One time point at different locations
- Hard to examine patterns (seasonality)
- Shifts in soil chemistry
- Shifts in microbial communities



Better understanding the ecology

Animals

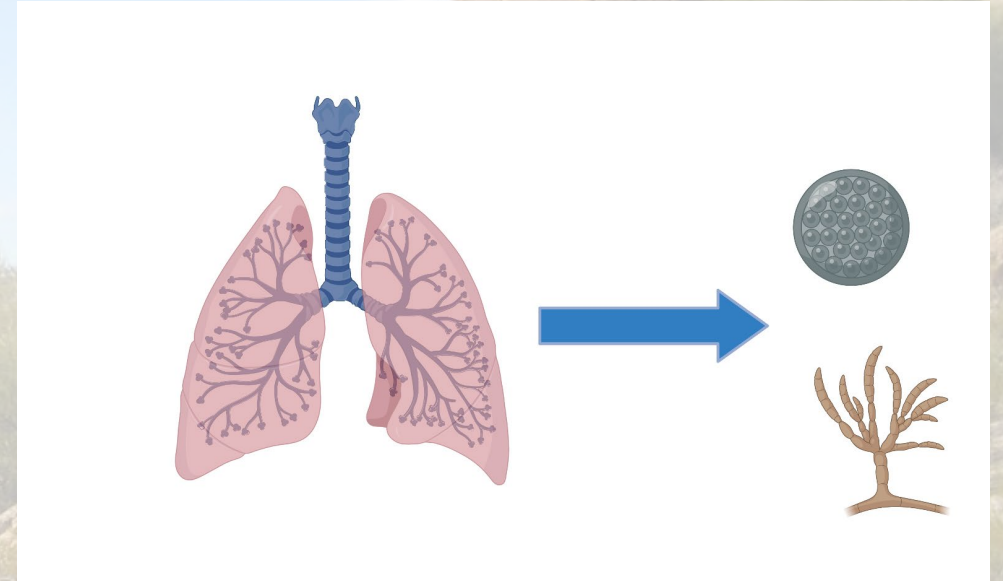
- a. Possible reservoirs
- b. Burrows are important
- c. Lung community

Dust

- a. Dispersal
- b. local vs. long distance

Soil

- a. Examine the microbial ecology (predictor variables)
- b. Temporal sampling



Temporal analysis

- **Monthly Soil Sampling (targeted and random)**
 - a. Physical and chemical properties of soil (+/-)
 - b. Climate fluctuations
- **Air sampling every six days**
- **Rodent sampling**
 - a. Diversity/abundance
 - b. Who is present at positive sites?
- **Examine temporal patterns between +/- sites**



Study Location

- Phoenix Metro area
- Ecologically diverse
 - a. Native desert
 - b. River basin
 - c. High abundance of wildlife
- Disturbed construction area



Marieke Ramsey MS student

Methods: soil sampling

Targeted approach

- Burrow systems
- 8 samples/ system
- 14 systems total



Random

- Transects-randomly sample every 5 meters
- Non-burrows



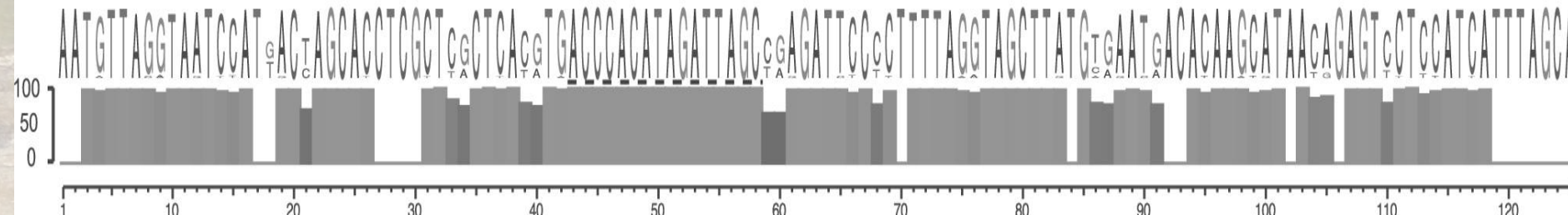
Molecular detection

- Taqman based real-time qPCR assay

CocciDx 91 unique alleles



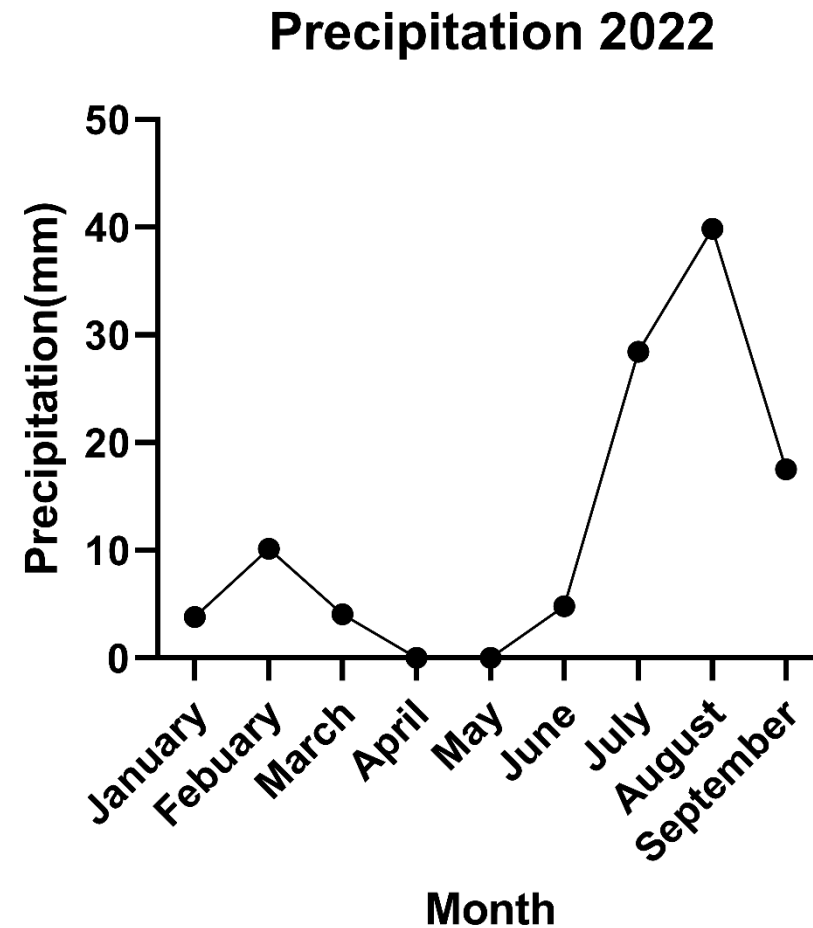
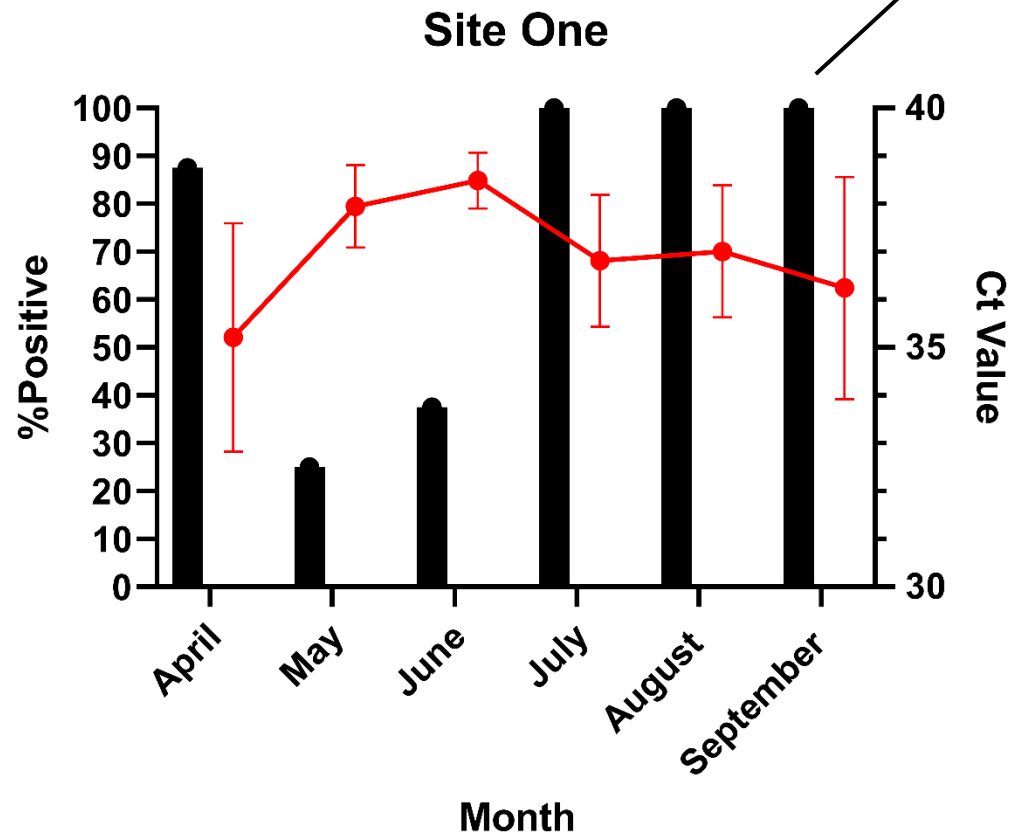
CocciEnv 496 unique alleles



Preliminary Results

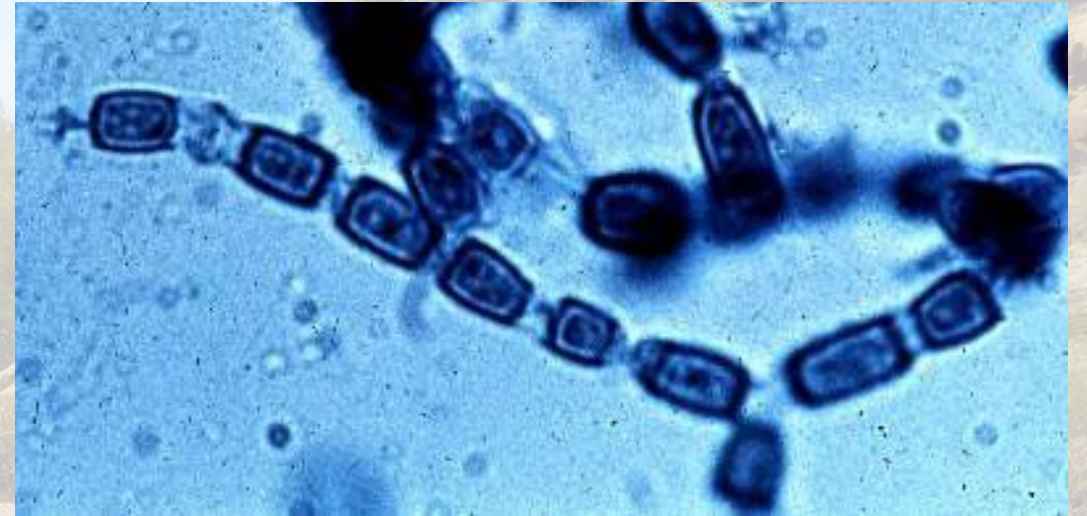
- Site 1: Burrow system


Air filter 1/16
positive
Ct value 37



Preliminary results: all sites

- 86 total samples
- 63/86 positive (73%)
- 14 different sites (burrow systems)
- 13/14 positive



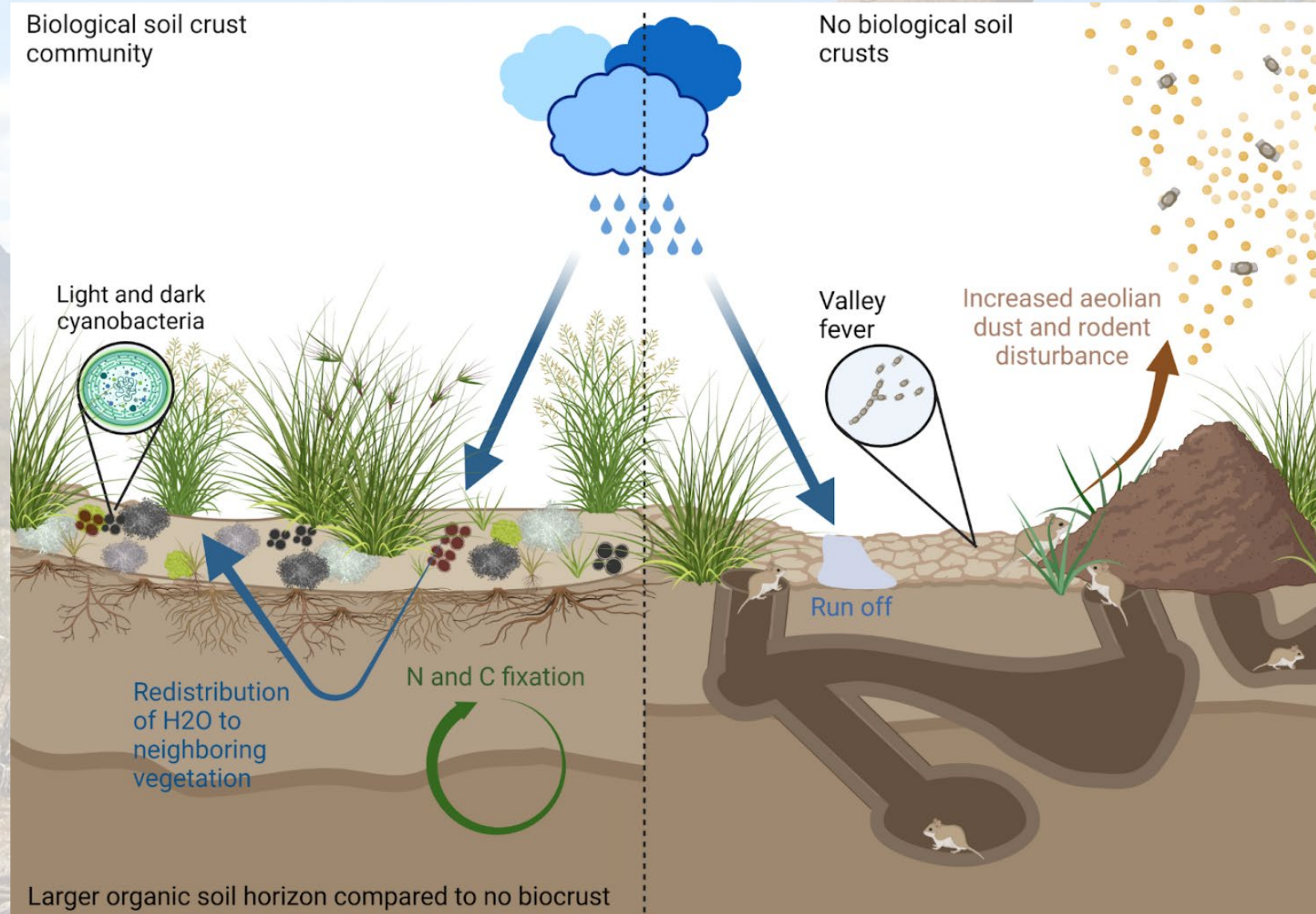
A wide-angle photograph of a desert landscape. In the foreground, there is dry, sandy ground with sparse, low-lying green and brown shrubs. A large, light-colored rock formation, possibly a boulder or small cliff, stands on the right side. To the left, several tall saguaro cacti are visible. In the background, a range of rugged, brown mountains stretches across the horizon under a bright blue sky with scattered white clouds. The text "Now what?" is overlaid in the center of the image.

Now what?

Ecological restoration

Biological soil crusts

- Consortium of different organisms
- Stabilize soil
- Reduce dust emissions
- Inhibit *Coccidioides* spp.
 - a. Direct (outcompete)
 - b. Indirect (reduce burrows and dust)



Preliminary Sampling

- 60 biocrust plots that varied in total cover of biocrust
- 20 rodent burrows surrounding the field site

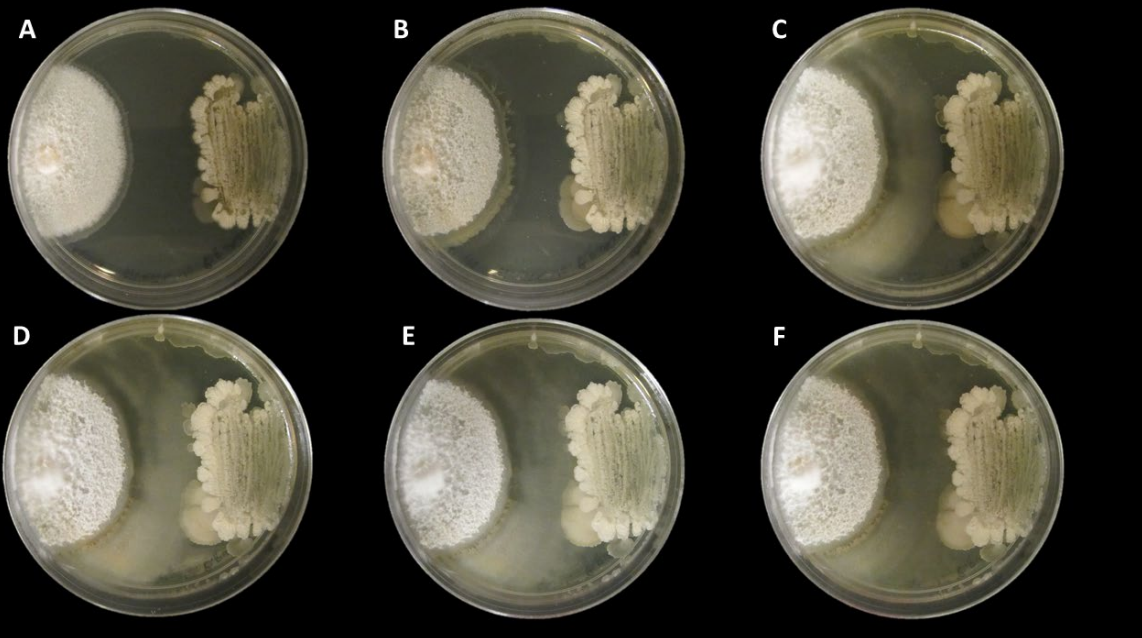
Results

- 2 positive burrows (10% positive)
- All Biocrust plots were negative

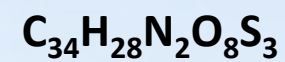


A desert landscape featuring a large, prominent rock formation on the right side. The foreground is filled with sparse desert vegetation, including low-lying shrubs and several tall saguaro cacti. In the background, a range of mountains is visible under a blue sky with scattered white clouds. The overall scene is arid and sunlit.

Biocontrol using naturally occurring microbes

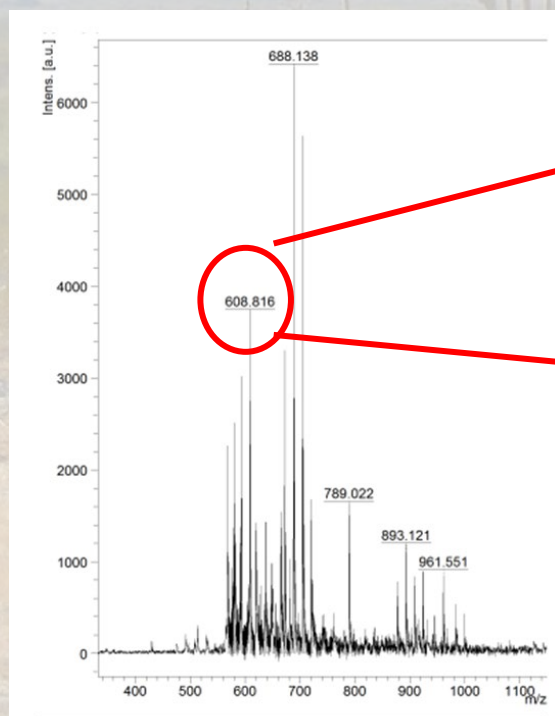
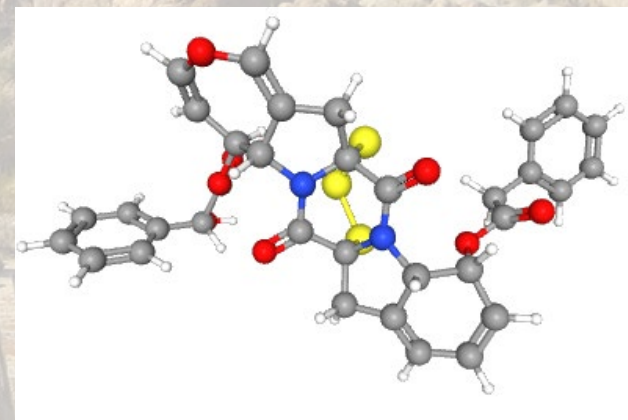


Emethallicin D



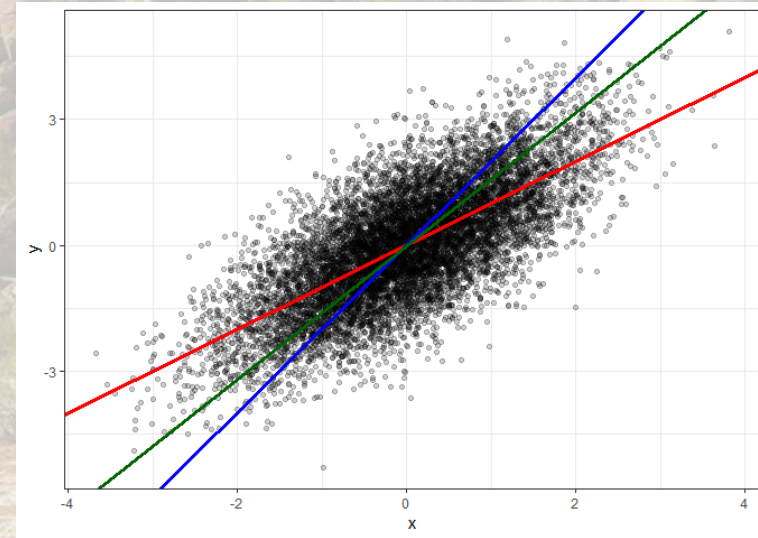
Known antifungal

Bacillus pumilus and *B. subtilis*



Future directions

- Differences in +/- samples (transient vs always positive)
 - a. Soil analysis
 - b. Animals (eDNA/trapping)
 - c. Climate
 - d. Predictor variables to establish patterns
- Continue Study for 3 years



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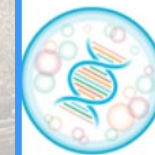
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PMI + NAU

The Pathogen and Microbiome Institute at Northern Arizona University