A Prickly Situation: Contrasting ecological functionality in three cactus species

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Question

What physiological characteristics determine ecologically functional differences in three species of cacti?

Double Mutualism & Facilitation

- Positive interactions drive ecosystem infrastructure[1]
- Birds are nectarivores and frugivores of cacti[2, 3]
  - Double mutualism: two positive interactions between interspecifics[4]
  - Harsh environments promote double mutualism[5]
- Cacti are desert foundational species[6]

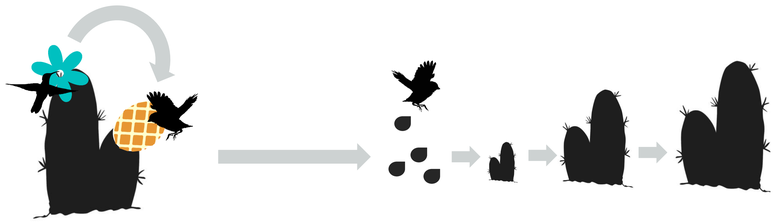


Figure 1: Birds pollinate and disperse seeds of foundational plants.

Hypotheses and Predictions

Different species of cacti occupy different ecological and facilitating niches.

- *Different cactuses will have different sizes and health which will impact interactor visitation at different phenological life stages.*

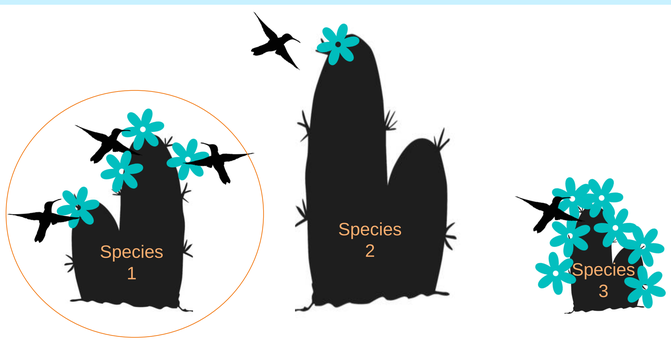


Figure 2: Avian interactors visit higher and showier reproductive displays.[7] Do these characteristics differ between cactus species?

Methods

- Transects or haphazard sampling
- Major axis, minor axis, vertical axis
- Health index 1-5
  - Scarification, rot, branch death

Results

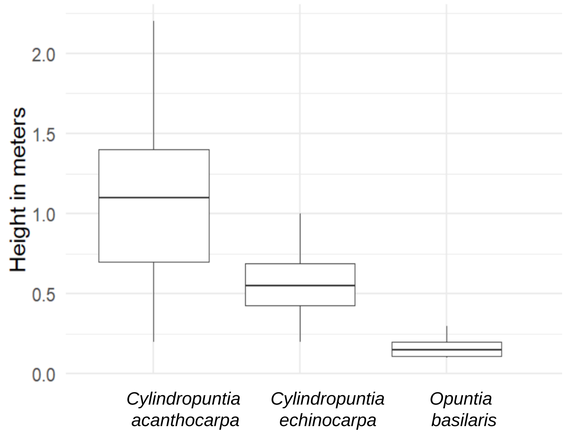


Figure 4: *C. acanthocarpa* (1.04 m) > *C. echinocarpa* (0.55 m) > *O. basilaris* (0.17 m)

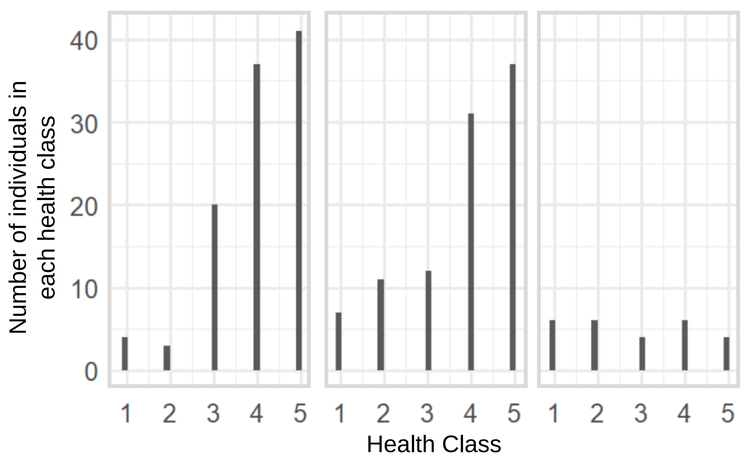


Figure 5: *C. acanthocarpa* and *C. echinocarpa* had more individuals with health scores of 4 or 5, whereas *O. basilaris* had a even distribution of health scores.

Each cactus species had significantly different mean heights (*Kruskal-Wallis*, Chi-square = 3.71, p > 0.0001, df = 52).

C. acanthocarpa and *C. echinocarpa* are healthier than *O. basilaris (Pearson's Chi-squared Test,* X-squared = 27.325, df = 8, p > 0.001).

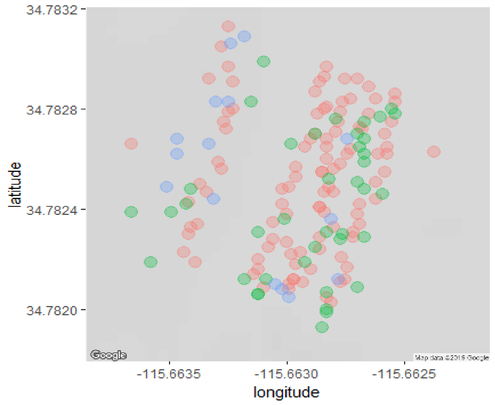


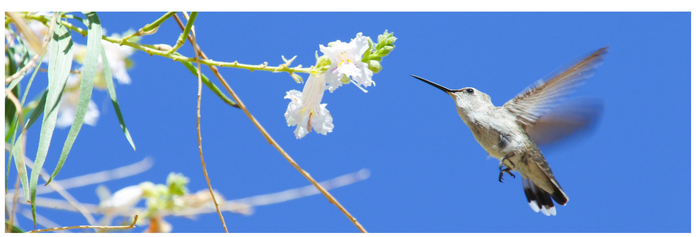
Figure 3: A map of three cactus species' locations and overlap.

Conclusions

These cacti are geographically overlapping, have varying heights, and have unique health. Therefore, they likely provide functionally different niches for nectarivorous and frugivorous birds.

Future Research

1. Survey reproductive outputs against morphological characteristics
2. Monitor bird interaction frequency and magnitude at different phenological stages
3. Determine foundational cacti's seed shadows facilitation



References

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