Metrics for Avian Double Mutualistic Interactions with *Cactaceae*

A Preliminary Analysis towards Network Interactions in a Desert Ecosystem

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Question

What species of cacti are most likely to facilitate double mutualistic interactions with birds?

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]

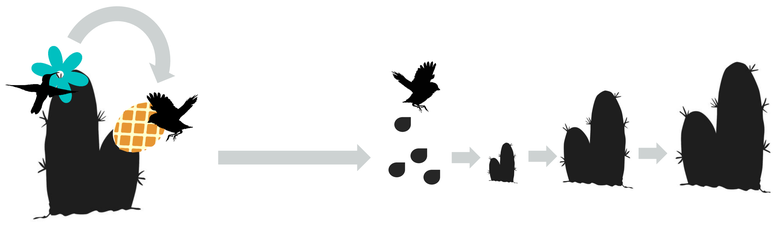

Figure 1: Do birds pollinate and disperse seeds of foundational plants?

Figure 2: Nectarivores visit higher and showier floral displays.[7]

Hypotheses and Predictions

- **Some cactus species are more attractive to pollinating and frugivorous birds than other**
  - *Different cactuses will have different sizes and health which may impact bird visitation*

Methods

- *Cylindropuntia acanthocarpa* & *Cylindropuntia enchinocarpa*: walk 6 and 9 transects, respectively
- *Opuntia basilaris*: haphazard
- Major axis, minor axis, vertical axis
- Health index 1-5
  - Scarification, rot, branch death
- Geotag

Results

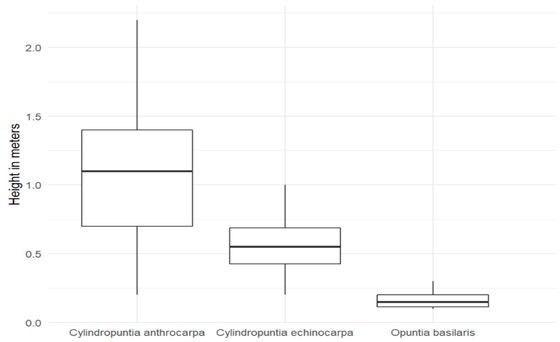

Figure 4: *C. acanthocarpa* (1.04 meters) > *C. echinocarpa* (0.55 meters) > *O. basilaris* (0.17 meters)

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

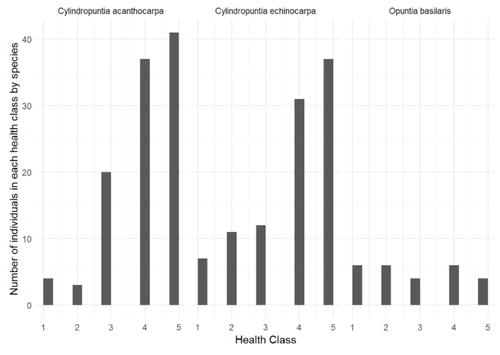

Figure 5: *C. acanthocarpa* and *C. echinocarpa* had more individuals with health scores of 4 or 5, whereas *O. basilaris* had a even distribution of health scores.

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

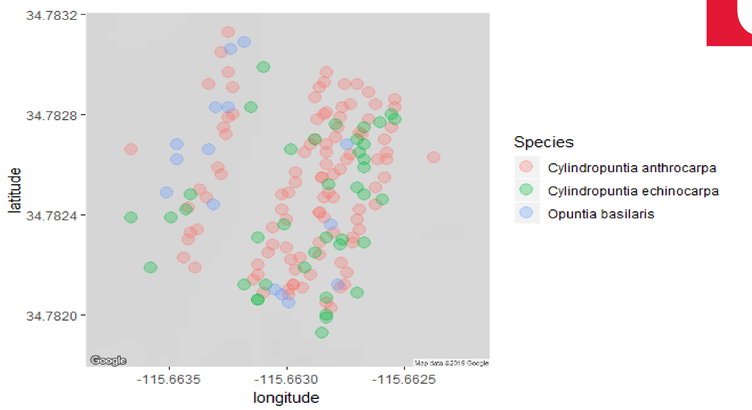

Figure 3: *C. acanthocarpa* was the most abundant and *O. basilaris* was the least abundant

Table 1: C. acanthocarpa had the largest size class bins.

Species	Small	Medium	Large
Cylindropuntia acanthocarpa	<85cm	86cm - 152cm	>153cm
Cylindropuntia echinocarpa	<45cm	46cm - 72cm	>73cm
Opuntia basilaris	<15cm	16cm - 22cm	>23cm

Conclusion

- Frequency, size, and health were all strongest in *C. acanthocarpa*
- Health will determine reproductive output, so healthiest species will have most success blooming/fruiting
- Larger, more distinct differences in height between individuals more likely to translate to bird behavior
- C. acanthocarpa will be study species in further experiments

Works Cited

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