Species coexistence is a major topic in community ecology. Ant communities are generally considered to be structured by competition, and have been used as a model to study coexistence globally. The stress gradient hypothesis states that competitive interactions decrease with stress. In general, there is some evidence that the importance of habitat filtering increases with stress. These predictions are generally not applied to animal communities. Combining taxonomic with trait-based approaches can provide insight into habitat filtering and competitive exclusion, as well as the spatial scale at which these process operate (Fichaux 2019). Trait values should be overdispersed at small spatial scales, and clustered at increasing scales.

Community assembly processes operate on different scales. At the macro scale, we expect that abiotic factors are the most important in structuring species distributions, however, there is increasing evidence that incorporating biotic interactions can improve our predictions of distributions. Co-occurrence data is not typically collected on a scale that allows for incorporating fine scale spatial variation and therefore is tough to use to infer biotic interactions. By using fine scale patterns, we can explain as much as possible and what is left over is likely biotic interactions. Understanding the drivers of ant community assembly will help understand the consequences of it.

Methods:

1. Extract ant species sampling locations from GBIF/GABI
2. Create SDMs for their US distributions
3. Create co-occurrence networks for a) different scale levels: Region, site, microsite and b) All species, Pairwise species c) Desert specialists vs generalists?
4. Create site-level environment variables

Ant assemblage beta-diversity

To test if ant assemblages at higher stress sites are subsets of lower, and to test if open assemblages are subsets of shrub or vice versa, use nestedness or turnover of beta diversity. Turnover is when species are replaced.

If the variation among species in some trait is larger than random (‘trait overdispersion’; Weiher & Keddy [1995](https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2745.12181#jec12181-bib-0050)), it is typically interpreted as an indication of competitive processes leading to divergence of trait values

Field methods

There are 9 nines and these were sampled three times each. Pitfall traps were placed beneath the canopy of a shrub and open areas, or the same number of traps at unshrubbed sites. They were left 72 hours, filled with propylene glycol. The percent vegetation cover, bare ground, vegetation height in the centre of quadrat, rocks over 5 cm diameter and woody debris were scored to sum to 100. The main vegetation type was recorded (typically grass or forb). IR sensors were used to record the daily temperature of the ground surface at each sites several times per day. The sampling locations were georeferenced.

Individuals were identified to genus using Fisher and Cover (2007), and to species using the AntWiki keys which are modifications of published keys. *Pheidole* and *Myrmecocystus* are currently at the generic level. Representative individuals of each species are also being barcoded.

Data was extracted from WorldClim using a central location for each site.

C-scores were calculated for the entire community at the pitfall…

The ground vegetation covariates were combined using PCA, because they sum to 100 they are correlated. The resulting PCA…

Questions:

* Are ant species more likely to competitively exclude their competitor when they are in their more optimal environment?
* How does habitat and the environment shape the taxonomic and functional composition, as well as co-occurrence, within ant communities?

Progress to date and preliminary results:

I have gone through the contents of half of the 648 pitfall traps, a total of 9394 individuals so far. The most abundant species are *Solenopsis xyloni*, a native fire ant, and *Pheidole*, big-headed ant. These species are both considered ecologically dominant in deserts. There is no evidence of *S. invicta*, or the argentine ant *Linepithema humile*, both major invaders across North America. There are about 11 species so far.

Preparation for progress report

PCA for vegetation structure

Map of 9 sites, with a table for max, mean temps for the month, aridity, precipitation

Future work:

Measure physical trait data: Weber’s body length, femur length and mandible length. The first is an all over body size trait, which is related to mobility and temperature preferences, among other things. Femur length and mandible length are both related to foraging ability, and if they scale non-allometrically, it points to… They would be divided by Weber’s body length.