* Introduction



* A positive interaction is an associaton between two (or more) interspecifics where at least one species’s relative fitness is increased. Usually referred to by the pathway that the interaction follows: plant-plant, plant-anima. Can also be three or more: plant-plant-animal, plant-animal-plant, etc.
* Facilitation is a common example of a positive interaction—it’s when a benefactor plant (for example, a shrub) provides some benefit to a protégé plant when the protégé grows under the benefactor’s canopy, thereby increasing its fitness (often by increased germination rates).
* When this happens and a single benefactor species is responsible for the recruitment of many different other plant species, and provides goods to animals (or even microbes) to the end that the ecosystem is strongly altered by the presence or absence of that benefactor, that species is known as a foundational species—since it is the foundation for an entire ecosystem.
* Often, you may also call these a keystone species, which is a species that has interactions with other species in the ecosystem, determining the make up of them.
* Keystone, foundational, and benefactor species aren’t always over lapping, but all work together to shape the ecosystem at large.
* In arid ecosystems, benefactor plants provide water and shade from harsh solar radiation, and protect against herbivory, wind, and freezing temperatures for juvenile plants under its canopy. Essentially, benefactor plants are little mini-oasis’s for juvenile interspecifics, which is why I’m formally requesting that the band “Oasis” change their name to benefactor plant.
* But before a benefactor can even provide these services, the seeds from a mother plant must be dispersed to these favorable habitats.



* I’m curious to what degree birds determine the success of juvenile plants moving from the mother plant to germinate elsewhere. Do birds determine the the seed shadow (or range of seed rain from the mother plant), and do they make seed rain fall in favorable environments (like under a benefactor shrub).
* So the big question I’m trying to help with is, are birds taking these purple paths to place seed rain under benefactor shrub canopies? Or to along the orange paths to end in open areas? Or both, but only the seeds that rode along the purple path germinate, with many seeds not contributing to the mother plant’s fitness?
* What we do know is that birds pollinate flowers and disperse seeds (by eating the fruits), two positive interactions with cacti.



* Pollination (specifically by hummingbirds) is an early step in fruit production. Because of this, it’s important to consider pollination as a function of fruit production, and eventual seed dispersal. That is, a seed can’t be dispersed until it’s be created. If I’m going to be studying how birds impact seed dispersal, I need to include how birds help   
  “create” seeds.
* Optimal foraging theory suggests that pollinators will seek nutrition in areas with food sources that cost the least energy to access while providing the most energy (basically, they do a cost-benefit analysis). It can predict foraging strategies based on characteristics of the foragers, like body size, based on characteristics of the plant (nectar volume, sugar content, even color). Therefore, we can use different qualities of plants and their flowers to determine which pollinators will interact with plants, and how strong their interactions will be!



* The more obvious relationship between birds and seed dispersal is that the fruit of some plants are eaten by birds and endozoochorously dispersed. Germination rates are often actually improved by passing through the guts of frugivores. Just to be clear, frugivory and seed dispersal is very different than seed predation, which is when granivores eat the seed of the plant, destroying it and its ability to germinate.
* Allocation theory is just the idea that different, competing plants must make different trade offs to fit different niches. In this study, we’ll be interested to see if our cacti of interest allocate resources (like nutrients) to both fruit and size—two factors that would potentially encourage frugivory, and therefore seed dispersal, to the end of increasing relative fitness.



* Walk through timeline
* Chapter 3 is going to have to be after I defend/if I switch to PhD/if I decide to stay longer? Issues of timing need to be discussed.



* For this chapter, I want to focus on this outlined, blue area. I need to first see how strong the first step of the interaction is, or the plant-animal interaction.



* For this chapter, we’re going to widen the scope of chapter 2, and really get at the plant-animal-plant length of the pathway (area of pathway highlighted by the blue dots)



* Do frugivorous birds perch on benefactor shrubs?
* Image, you can see ash-throated flycatcher (an insectivorous bird) perching on Larrea tridentate, a known benefactor shrub for saguaro



* Deserts, like many biomes, are experiencing severe degradation bc of climate change and human development. When we understand the pathways of positive interactions, we understand how ecosystems build/expand their infrastructure. When we understand that, we can figure out how to most effectively restore and protect

1. Yay! Chat time