# The Ecology, Evolution and Conservation of Pollination

**Instructor**
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**Overview**
All organisms reproduce – and among organisms, plants reproduce in the most diverse ways. In some plant species, all individuals are the same sex; other plants have two sexes, yet others three or even four sexes. Reproduction takes place via flowers that range from the size of a pinhead to the size and weight of a toddler. Some plants make flowers, but then fertilize only themselves. Most, however, require pollen to be moved between flowers, a feat accomplished by wind, water, and animals ranging from insects to fish to birds and mammals. These animals, in turn, are heavily dependent upon resources that flowers provide. Studies of pollination are revealing how species interactions weave together ecological communities. However, human-caused environmental change is threatening pollination, leading to impacts ranging from biodiversity loss to the loss of our food supply. In this course we will explore the weird and wonderful world of pollination across the globe (with a special focus on deserts), as well as across time, from its earliest origins to its increasingly fragile future.

**Schedule**
Fridays 10 AM - 12 PM
September 29, October 6, 13, 20, and 27, 2023

**General Plan**
There are no materials to purchase for this course*. One or two readings (posted as PDFs) and occasional video clips will be provided in advance of each class. It is not necessary to have gone through this material in order to understand the lectures. It will, however, provide food for thought, and is likely to generate interesting questions and lively discussion!

> *If students want to read more about this topic on their own, then I urge them to look at the popular books of Steven Buchmann, one of the world's leading pollination biologists and a resident of Tucson: *The Forgotten Pollinators* (with Gary Nabhan, 1996), *The Reason for Flowers* (2016), and *What a Bee Knows* (2023). I will not be teaching from these books, but they are wonderful.

Each class will be broken up roughly as follows: there will be 40 minutes of lecture, 10 minutes of questions and discussion, then a 10-minute break, followed by 40 minutes of lecture and a final 20-minute discussion period.

Here is a short overview of the lectures.

**Session 1, September 29**

***Introduction to pollination***

Some great natural history to start us off
How do plants get their pollen moved? Biotic and abiotic pollination
How old is pollination? Evidence from fossils
Which animals are the most important pollinators?
Why do animals visit flowers anyway?
Do plants and pollinators match up one-to-one? Specialization and generalization
A virtual walk through Tucson plant-pollinator interactions
Pollination matters to us all
Key takeaways from this lecture:

- Plant-pollinator interactions are everywhere, and highly diverse
- Pollinators don't visit flowers to "help" – they are in it for themselves
- Pollination is a wonderful playground for studying adaptation in nature!
- Pollination matters for the health of the planet, and of ourselves

**Session 2, October 6**

***The plant perspective on pollination***

Some great natural history to start us off
The benefit of exchanging genes – and the challenge of being sessile
Plant sex! Plant breeding systems and their relationship to pollination
Floral diversity: size, shape, number, and pollinator attractants
Specialization, obligacy, and generalization: the plant perspective
How flowers, and pollination, have evolved
Revisiting our virtual walk through Tucson plant-pollinator interactions: *how diverse are our pollination and breeding systems?*
Key takeaways from this lecture:

- Plants have surprisingly diverse sexual systems
- Natural selection has shaped floral traits in weird and wonderful ways

**Session 3, October 13**

***The animal perspective on pollination***

Some great natural history to start us off
Who visits flowers and why
The ins and outs of how pollinators feed and move
Specialization, obligacy, and generalization: the animal perspective
Combining perspectives: have plants and pollinators coevolved?
Revisiting our virtual walk through Tucson plant-pollinator interactions: *who are the major pollinators?*
Key takeaways from this lecture:

- Flowers are sources of critical resources for diverse animals
- Floral visitors are in it for themselves – and not all of them are good pollinators
- The study of pollinators has illuminated our broader understanding of animal behavior

**Section 4, October 20**

***Scaling up: plant-pollinator communities***

Some great natural history to start us off
Community ecology of pollination: cooperation and competition for partners
Social networks in the natural world
Cheating plants and cheating pollinators
Interactions among interactions: pollination and seed dispersal; pollination and protection; pollination and herbivory
How the tropics are special
Revisiting our virtual walk through Tucson plant-pollinator interactions: *how does pollination weave together these communities?*
Key takeaways from this lecture:

- Plant-pollinator interactions weave together ecological communities
- Pollination can only be understood in the context of larger community processes

**Session 5, October 27**

***The fate of pollination in the Anthropocene***

Some great natural history to start us off
Why we must conserve pollination systems
The major threats to the persistence of plant-pollinator interactions
Which pollination systems must we worry about the most?
Restoring disrupted interactions: challenges, and a few successes
The role of citizen science
A final revisit to our virtual walk through Tucson plant-pollinator interactions: *which are most at risk, and how can we foster their health?*
Key takeaways from this course

- You can make a good guess, looking at a flower, who pollinates it
- Plant-pollinator interactions are crazy-diverse – but the variation is interpretable and makes sense
- So much isn't known … and there is a role for citizen scientists in filling the gaps
- Securing the health of pollinators and pollination systems is critical to the future of ourselves and our planet