



Backyard pollinators:

A Teacher's Resource Guide

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What is pollination?

Pollination is how plants sexually reproduce. Pollen travels from anthers, the flower's male reproductive organs, to stigma, the flower's female organs (Fig. 1). A flower must receive pollen from the same species for successful fertilization of its ovules to occur (Fig. 1). Fertilized ovules then become seeds. Seeds become new plants and the cycle begins again. Self-pollinating plants only require pollen be moved from anther to stigma of the same flower or same individual plant. For cross-pollinating plant species, pollen must make its way to the stigma of flowers on a different plant.

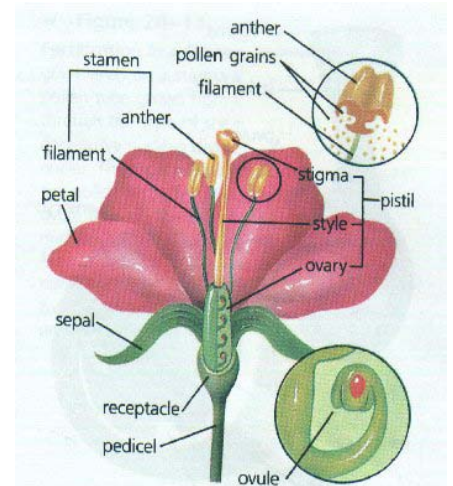


Figure 1. Flower morphology
<http://biology.unm.edu>

What is a pollinator?

Plants cannot move, so they recruit wind, water and animals to vector pollen between flowers. Animal vectors are called pollinators. Some pollinators are better than others. The best pollinators deposit enough pollen for fertilization and like to visit the same type of plant over and over again. A pollinator that visits the same plant increases the chance that a stigma will receive pollen of the same species. When we think of pollinators, we generally think of bees, but pollinators include a diversity of other invertebrates and vertebrates:

Invertebrates



Vertebrates



Hummingbirds



Bats



Lizards – tropical islands

Why do pollinators visit flowers?

Pollinators do not visit plants because they want to help out. Most visit flowers for food and unknowingly pollinate in the process. Flowers provide two food rewards: nectar and pollen. Nectar is a sugary, liquid sought by almost all pollinators. Nectar is perfect fuel for energy intensive flight. Bees are unique among pollinators by actively collecting pollen, as opposed to passively acquiring pollen in their hairs. Pollen is protein rich, and bees feed it to their young. Bees have electrostatic, branched hairs and pollen baskets that are specially adapted for picking up as much pollen as possible. Bees generally move more pollen than other animals, which makes them important pollinators.



Bee covered in pollen



Branched hairs of a bee



How do plants recruit pollinators?

Plants attract pollinators to their flowers by advertising their floral rewards (nectar and pollen). They have taken advantage of the fact that animals see, smell and taste the world differently, by evolving different flower sizes, shapes, colors and scents to selectively attract pollinators. For example, insects see smaller wavelengths (range from UV to green) than do vertebrates (blue to red). Bats and birds seek larger quantities of nectar than insects. Nocturnal pollinators cannot see color in the dark, but can use smells and light colored flowers to navigate to a flower. Suites of floral characteristics that tend to attract a particular group of pollinators have been organized into categories called **pollination syndromes**. Here are some examples:



Bee pollinated: Brightly colored flowers (except red which bees cannot see) are most attractive to bees. Bees use their keen sense of smell to choose flowers with sweet, sugar-loaded nectar. Color and UV nectar guides help bees find concealed nectar quickly (see figure to left). Once a flower is pollinated, these nectar guides fade.



Butterfly pollinated: Butterflies have similar eye-sight as bees, however, many can see red. They visit bright colored flowers. They enjoy faint sweet scents and require a landing pad from which to feed because they cannot hover. Butterfly tongues are long and thin, so flowers may look like thin tubes.

Bat pollinated: Bats look for nectar at night when it is dark, so flowers emit strong, thick sweet smells that can be followed to the source. Flowers also do not benefit from being colorful; instead they are showy white or day-camouflaged green and purple. Because bats are relatively large and need much energy for flight, flowers provide large nectar quantities.

Moth pollinated: Like bats, moths visit flowers at night, which emit strong, thick sweet smells. Flowers tend to be white. Smaller nectar quantities are hidden in long spurs, which moths access with their long tongues. UV guides are not present since they cannot be seen at night.

Fly pollinated: Flowers imitate the odor and color of rotting fruit or dung to attract flies. Sometimes, they can even heat themselves up to mimic a recently deceased body.

Who are our backyard pollinators?

All of the animal pollinators mentioned above, except for bats and lizards, can be found in your back yard (pollinating bats and lizards are found in deserts and tropical islands, respectively). The diversity of our backyard pollinators is surprising. The bees of New York State, alone, comprise over 400 species!

What is the status of our backyard pollinators?

One third of our food is pollinator dependent. New York without pollinators would mean Halloween without pumpkins and fall pies without apples. Unfortunately, wild pollinator numbers have precipitously declined in the last 50 years, as have wild plants that rely on animal pollination. The primary cause of declines is habitat loss due to human development.

Even our most important managed pollinator, the European honey bee, is not faring well with increased incidence of disease and stress from pesticides and inadequate food supplies.



Eastern Bumble Bee

How can we make our backyards more pollinator friendly?

Provide food all year. Plant combinations of native flowers that will bloom spring, summer, and fall. Grass lawns are deserts for bees, with no food value. Convert lawn to wild flowers or delay mowing to allow weeds to bloom. Hummingbird feeders provide food and a chance to observe hummingbirds up close.

Provide safe nesting sites. Maintain areas with bare, well-drained soil. Some bees need mud for nest building, so provide water if none nearby. Make or buy nesting houses (see resources listed below for suppliers).

Protect pollinators from pesticides. Avoid use of chemical herbicides and pesticides in your garden. If necessary, apply at night or very early before pollinators become active.

Resources:

- **US Forest Service** provides excellent, basic information about pollinators. This site includes activities for kids, teacher resource guides on native pollinators, additional descriptions of pollinator syndromes and more.
<http://www.fs.fed.us/wildflowers/pollinators/index.shtml>
- **The Pollinator Partnership** is a national coalition of government, educational and nonprofit groups aimed at pollinator conservation. A portal for information about pollinators and how to conserve them. Includes teaching curriculum for 3-6th graders and other educational resources. Regional planting guides can be found here.
<http://www.pollinator.org/>
- **The Xerces Society**, a non-profit focused on invertebrate conservation, is leading efforts in the US to conserve pollinators. Practical information on pollinator conservation can be found at this site, including how to make your garden, farm, park, golf-course more pollinator friendly. Another excellent place to begin to learn more about the importance of pollinators and how to conserve them.
<http://www.xerces.org/pollinator-conservation/>
- **The Great Sunflower Project** is a citizen science program that involves the public in collecting pollinator data from sunflowers planted in their garden. These data will help monitor changes in pollinator abundances over time and inform conservation.
<http://www.greatsunflower.org/>
- **UV Flowers** provides the best professional photos of floral UV patterns I have seen.
<http://www.naturfotograf.com/>
- **Knox Cellars** (www.knoxcellars.com) and **Pollinator Paradise** (www.pollinatorparadise.com) are commercial sites where one can purchase nests and stem-nesting bees. They also provide background information on stem-nesters.