



POLLINATOR GARDEN TOOLKIT

EARTH DAY NETWORK



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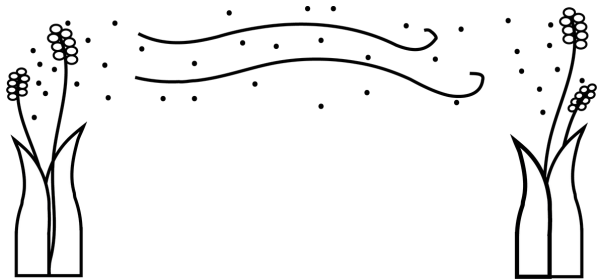




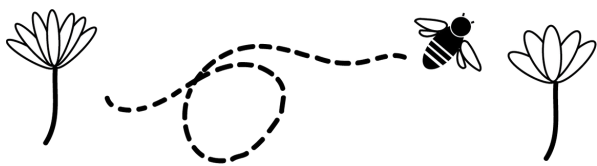
I. What is pollination?

Pollination is a process that is imperative to the success of nearly all-terrestrial life on earth. The process of pollination occurs naturally through abiotic or biotic processes, meaning it is assisted by living or nonliving forces. Pollination occurs when pollen is transferred from one flower to another, allowing the plants to reproduce. Pollen, the genetic material transferred from one plant to another, fertilizes the egg of a female plant and allows for seed production to occur (1,2).

Abiotic Pollination



Biotic Pollination



This process is responsible for the reproduction of nearly all plant life on earth, and consequently supports the survival of most animal life as well. Primary producers, or plants, are eaten by herbivores and omnivores, who are then eaten by predators. All of these creatures rely on healthy plant populations to survive, so it is important that pollinator populations are abundant and healthy to maintain balance in the food chain.

Abiotic pollination relies on forces in the environment like wind, air, and rain to distribute pollen.

Examples:

- Grasses
- Coniferous
- Deciduous trees
- Aquatic plant species

Biotic pollination relies on live organisms, or pollinators, to transport pollen from one individual to another.

Examples:

- Bees and Wasps
- Butterflies
- Hummingbirds
- Bats
- Songbirds



Pollinator gardens are made up of native plants that provide a source of food and shelter to other local species. Pollinators thrive off the nectar from the plants, but a variety of other species of birds and mammals depend on these plants for food and shelter. When we plant pollinator gardens, we encourage the positive interactions that happen in nature to occur supporting a healthy, biodiverse ecosystem.

Humans need healthy pollinator populations to support our food system and our economy. We rely so much on pollinators that apiarists, or beekeepers, travel around the country with beehives to pollinate crops! Pollination is so important that if we lost our pollinators, it would dramatically alter what foods are available to us, changing our diets and threatening access to nutritional food. In fact, we rely on pollination so heavily that the Food and Agriculture Organization of the United Nations determined it supports the production of crops estimated to be valued between US\$235 and US\$577 billion a year globally (3). Moreover, about 80 to 95 percent of the plant species within our local ecosystems need animal-mediated pollination (4). If we lost pollinators, we'd also lose the habitats that are unique and special to the places we live and visit!



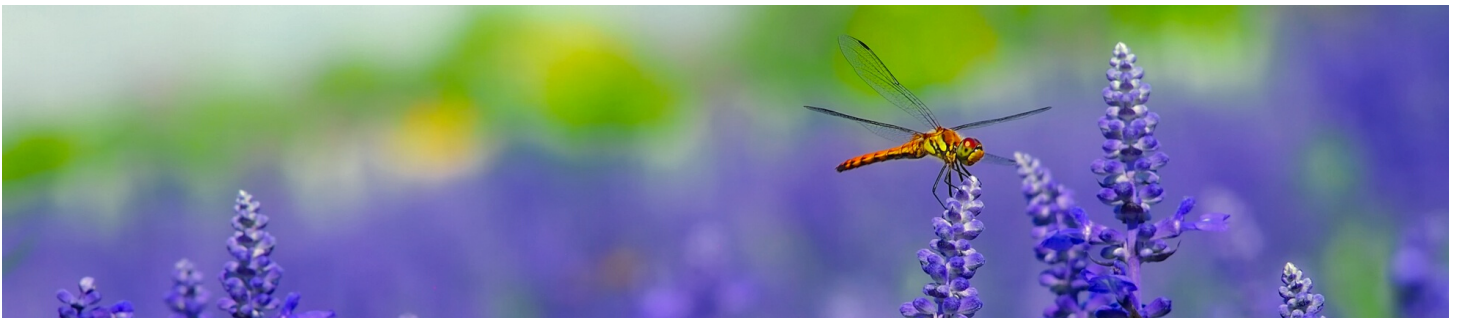


II. Threats to pollinators

In the last 30 years, pollinator populations have seen a sharp decline around the world. For example, this past year alone about 40.7 percent of honeybee colonies were lost during the winter (5). Honeybees are one of the most important pollinators and are responsible for \$15 billion worth of food crops that are consumed and sold in the United States (6). This decline is due to several factors, including climate change and human caused habitat destruction.

Unfortunately, pollinator decline is not specific to the United States. One study in Germany discovered that there had been a 70% decline in flying insects in the last 30 years (7).

This decline is significant as humans need pollinators in order to feed our families, animals and livestock. If we are unable to fertilize plants used in food production, we will lose a major source of nutrition in our diets. Furthermore, should pollinator populations continue to decline, we would effectively see an overall decline in plants that rely on biotic pollination. These declines could lead to a decrease in overall biodiversity in many habitats as species that rely on affected plants struggle to find suitable alternatives.



i. Habitat loss

Continuous development of cities and suburban areas has rapidly destroyed pollinator habitats globally. Popular urban and residential landscaping has not been designed with wildlife in mind, and suitable places to nest, feed and reproduce can be difficult to find. Yards and gardens have been styled with mulch, nicely mowed lawns and exotic plants. While these may be aesthetically pleasing, they actively remove habitats that are suitable for pollinator activities. Woody and leafy hiding spots that serve as excellent spaces for insects and pollinators are actively stripped when we coat our natural spaces with grass and mulch.



Mulch is often dyed to suit the color scheme of an area and does not attract pollinators. Moreover, our native pollinators have evolved to pollinate our native plants. By filling our yards with non-native flowers, the mechanisms native pollinators have developed to pollinate are ineffective and they are unable to feed!

ii. Introduction of invasive species

Non-native species of plants have a significant impact on a pollinators ability to function within their environment. Invasive species are species that are native to one part of the world and are transported to another location, which can dramatically disrupt habitats and harm native species. Invasive species often outcompete native species for light and take over large swaths of land preventing native species from accessing components essential to survival. We introduce non-native species when we intentionally or unintentionally bring new species into our habitats. This can happen by carrying seeds on the bottom of our shoes as we travel. It can also happen when we purposefully introduce an exotic species for the aesthetic value and they begin to take over native habitat.



Above: Purple Loosestrife is a common invasive species across the United States

iii. Climate Change

Climate change poses a threat to insect and pollinator populations as it will change habitats at a rapid rate without allowing pollinators the time to adapt.

Our changing climate is altering habitats all over the world; in temperature, amounts of rainfall and through extreme weather. As our long term weather patterns change, some pollinators will experience their range of suitable habitats becoming larger, while others may experience their habitat range shrinking or becoming unstable. Shifting ranges will result in species having to adapt to new species migrating into their habitats. Species that may not have originally had overlapping ranges will be forced to interact and compete with one another.



Moreover, increased numbers of extreme weather events may contribute to population decline. For example, in 2002 a freak storm in Mexico froze an estimated 220-270 million monarch butterflies, nearly 74% and 80% of the Sierra Chincua and Rosario colonies, respectively (8). This single event contributed to the overall decline of monarch populations, with the species now considered threatened with extinction (8).

iv. Pesticides

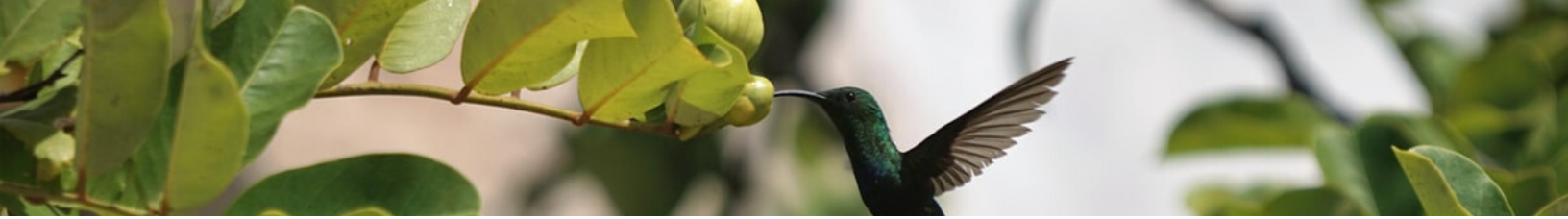
Humans have developed an assortment of products that enhance our quality of life, in many cases at the expense of the natural world. Pesticides and fertilizers are a great example. These products are effective in allowing humans to mass produce crops, but do so at a huge cost to native insect populations. In 2016 Geoff Williams, an entomologist from Auburn University, found that the use of neonicotinoids, a common agricultural pesticide could be responsible for acting as a contraceptive for bees (9). He found that bees exposed to concentrations of neonicotinoids produce 39 percent less viable sperm to queens who have not mated yet (9).



Above: Pesticides have far reaching impacts, affecting critters in neighboring ecosystems

Pesticides are also extremely effective in killing insects that farmers or gardeners consider harmful to their crop. These chemicals are also effective in killing other insects that come into contact with them. Pollinators are drawn to crops for food and become innocent bystanders impacted by our chemicals. Moreover, when spraying pesticides, the chemicals often leech into the surrounding ecosystems, affecting more than just the insects they were intended for. Studies have shown pesticides and insecticides can significantly impact populations of amphibians, fish, and birds.





III. Pollinator garden guide

Starting your pollinator garden

Pollinator gardens can help alleviate some of the strain on pollinator populations in your community by providing safe areas for pollinators to reside and access to plentiful native food sources. This toolkit will guide you through how to create a pollinator garden and what elements to include. As you explore creating a pollinator garden in your community look to your local conservation departments or nonprofits to learn more about what species are native to your area. Having a solid understanding of what pollinators are nearby and what threats they face will help you pick the right plant species and design your garden to best suit them. They will appreciate you designing healthy habitats just for them!

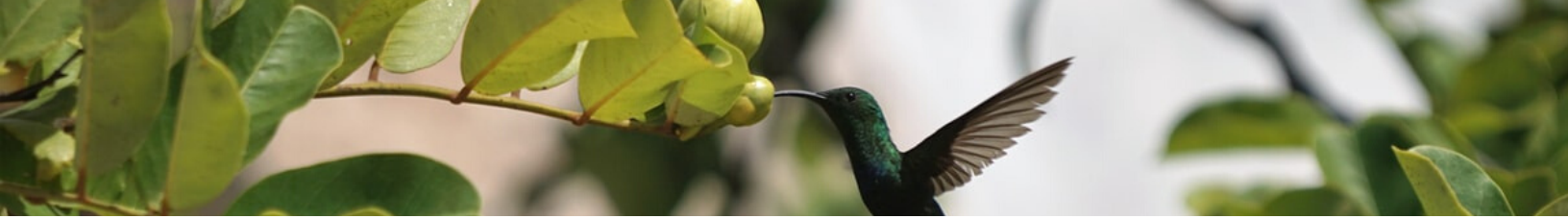


Above: Wildflower fields are a great resource for pollinators and other small critters

i. Benefits of a pollinator garden

A pollinator garden is a garden that is planted predominately with flowers that provide nectar or pollen for a wide range of pollinators. A pollinator garden usually includes largeranges of flower types, shapes and sizes that are in a sunny area. Usually plants and flowers of the same type are grouped together, this assists with pollination in great number (10).

- Boost ecosystem health by encouraging biodiversity.
- Reduce the need for pesticides and herbicides: Native plants out compete weeds and provide space for local pollinators.
- Provide rest stop areas for migratory pollinators like Monarch Butterflies.
- Cost effective, most species will persist until next year!
- Easier than planting and replanting annuals.



ii. Creating a successful pollinator garden

Pollinator gardens provide a safe haven for pollinators to nest, gather food and reproduce. This helps strengthen pollinator populations and increases ecosystem stability. What your pollinator garden should include depends on your location and what species are native to your region. Below are general details that should be taken into consideration when creating a pollinator garden. Reach out to your local conservation departments and nonprofits for more information on the needs of pollinators and plants native to you.

Choose plants native to your area

It is important you choose native plants that your region's pollinators are specifically adapted to feed from. To increase the diversity of pollinators, plant a variety of native plants!



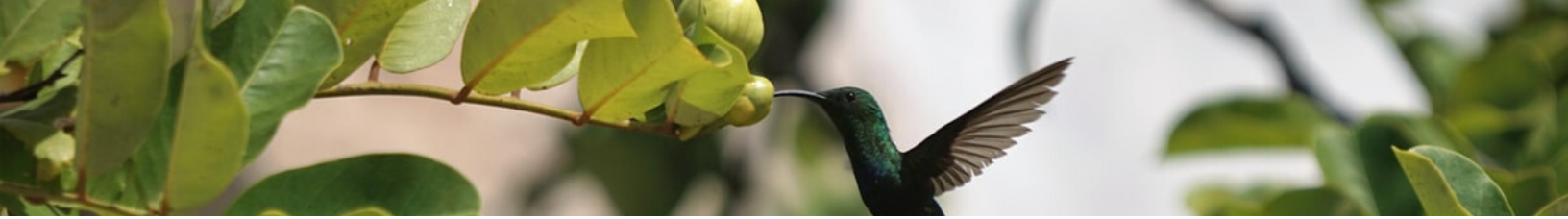
Above: Milkweed is important as it provides food and shelter to young monarch caterpillars

Plant species with varying blooming cycles

Pollinators feed at different times throughout the year based on their reproduction and migration cycles. Plant species that have diverse blooming cycles so that your garden will provide habitat and resources throughout the year to meet their diverse needs. Overlapping blooming time allows for pollinators to consistently access the resources they need to thrive.

Choose nectar and pollen rich flowers with a range of shapes, sizes and color

Pollinators thrive when gardens are full of diverse plant species! Pollinators can be birds, insects and other animals with diverse body shapes and behaviors. The way these creatures get nectar and collect pollen differ as much as they do! We recommend planting a vast abundance of different floral plant species to provide the best shapes, sizes and smells for your native pollen distributors. When building your garden, keep in mind the species in your area you'd like to most attract!



Avoid modern hybrids

We also recommend purchasing older heirloom varieties of plants that are known to have nectar and pollen. Some species of plants have been bred to maximize the amount of time it blooms and to give the flowers a more vibrant color. Given this, not all modern hybrid plant species may produce enough nectar or pollen to help important critters. Make sure to do your research on what species and breeds will produce the most food for your garden buffet!

Avoid landscape fabric and mulch

Landscape fabric and mulch are helpful to keep your garden neat as an ornamental fixture, but can hinder how pollinators access the nectar within plants. When planting native plant species in your garden consider planting in clusters. When plants are close together they work together to keep weeds out of their way. You'll never have to go through another exhausting mulching season and your yard will be a haven for pollinating critters!

Save perennial garden cleanup for spring

Pollinator gardens can also support species after pollen and nectar stores are done for the summer. Some insects spend their winters in hollow stems, while others attach themselves to plants or nestle in leaf litter. To help pollinators survive the winter, consider waiting to cut down your perennial gardens until spring! Additionally, leaving beds of leaves around your yard or green space can support a variety of insects throughout cold winter months.



More resources on creating pollinator and wildlife friendly habitats:

- National Wildlife Federation's Garden for Wildlife
 - [Elements of a Wildlife Habitat](#)
 - [Garden Certification Checklist](#)
- [Pollinator Partnership](#)
- [Kids Gardening Pollinator Resources](#)
- [US Forest Service Monarch Butterfly resources](#)
- [Million Pollinator Gardens resources](#)
- [Pollinator friendly plants by state \(US only\)](#)



IV. Works Cited

1. <https://botgarden.uga.edu/wp-content/uploads/2016/11/c2ppollinator.pdf>
2. <https://www.britannica.com/science/plant-reproductive-system/Angiosperms>
3. <http://www.fao.org/3/i9527en/i9527en.pdf>
4. <https://ento.psu.edu/pollinators/resources-and-outreach/what-are-pollinators-and-why-do-we-need-them>
5. <https://www.sciencedaily.com/releases/2019/06/190619142532.htm>
6. https://www.panna.org/sites/default/files/EconValue_US%20Pollination_Morse&Calderone_0.pdf
7. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>
8. <https://www.nytimes.com/2002/02/12/world/storm-in-mexico-devastates-monarch-butterfly-colonies.html>This
9. <https://royalsocietypublishing.org/doi/full/11098/rspb.2016.050610>.
10. https://www.fs.fed.us/wildflowers/pollinators/Plant_Strategies/index.shtml